CHICAGO TRANSIT AUTHORITY

SPECIFICATIONS

FOR

RAPID TRANSIT CARS

[redacted]

NO. RRE-3000-63

MARCH 1963

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CHICAGO TRANSIT AUTHORITY

GENERAL AND DETAIL SPECIFICATIONS
FOR RAPID TRANSIT CARS

NO. RRE-3000-63

MARCH 1963

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CHICAGO TRANSIT AUTHORITY

GENERAL SPECIFICATIONS

FOR

RAPID TRANSIT

ELEVATED-SUBWAY PASSENGER MOTOR CARS

SPECIFICATION NO. RRE-3000-63

PAGES

GS-1 to GS-11

GENERAL SPECIFICATIONS

SECTION 1 - DESCRIPTION OF CONTRACT DOCUMENTS

The Contract Documents for this contract consist of the following component parts:

Advertisement for Bids, Instructions to Bidders, General Specifications, Detail Specifications, Proposal and Non-Collusion Affidavit are contained within these Contract Documents. Any addenda which may be issued shall be a part of these Contract Documents and shall take precedence over any other part of the Contract Documents wherever they conflict therewith.

Contract prints, if any, may be attached to these Contract Documents or may be bound and issued as separate documents.

SECTION 2 - DEFINITION OF TERMS AS USED IN THESE SPECIFICATIONS

Wherever in the Contract Documents the following terms or pronouns in place of them, or abbreviations are used, the intent and meaning shall be interpreted as follows:

(a) "Chicago Transit Authority", "Transit Authority" or "Authority" means Chicago Transit Authority, a Municipal Corporation created by the Metropolitan Transit Authority Act, approved April 12, 1945;

(b) "Chicago Transit Board" or "Board" means the governing and administrative body of Chicago Transit Authority;

(c) "Chairman" means the Chairman of the Chicago Transit Board, or his successor or successors upon whom his duties may devolve;

(d) "Secretary" means the Secretary of Chicago Transit Board;

(e) "Engineer" means General Manager of Chicago Transit Authority or any other person designated by him to be the Engineer in charge of all or any part of the work;

(f) "Company" means the Chicago Transit Authority, its Engineer or its authorized representatives;

(g) "Car Builder", "Builder" or "Contractor" means the builder of the car body and assembler of the complete car;

(h) "Truck Builder" means the assembler of the car trucks and truck accessories;

SECTION 2 - DEFINITIONS OF TERMS AS USED IN THESE SPECIFICATIONS (Cont'd.)

(i) "Manufacturer" means the original manufacturer supplying material, equipment or apparatus for installation on the car;

(j) "Written Order" means a written order signed by the Engineer or his duly authorized representative, mailed to the Contractor at the address designated in his proposal or to such other address as he may designate in writing as his official place of business;

(k) "Trustee" means such bank or trust company, or banks or trust companies, to which title to the Rapid Transit Cars is conveyed or provided to be conveyed pursuant to Section 10 of these General Specifications; and wherever in these General Specifications the singular "Trustee" is used, it is understood that such word shall include each of the several Trustees to whom any part of the Rapid Transit Cars, which are the subject matter of these specifications is, pursuant to Section 10 of these General Specifications, provided to be conveyed by the terms of the contract or by the terms of any later designation thereafter made by the Authority pursuant to the terms of such contract.

(l) Whenever the words "approved", "equal to", or "equal in quality and performance" are used in connection with design, make or quality of equipment or material called for in these specifications, the Engineer shall decide, before awarding of contract, whether or not equipment or material is equal to that specified.

SECTION 3 - CONTRACT SECURITY

The Contractor shall, if so requested by the Authority, furnish a Performance Bond, guaranteeing faithful performance of all the terms and conditions of the contract. The surety on this bond shall be a surety company chosen by the Authority and the Authority will pay the premium. The Contractor shall render all assistance necessary in the procuring of such bond.

SECTION 4 - ASSIGNMENT OF CONTRACT BY CONTRACTOR

The Contractor shall not assign the contract or any part thereof without the written consent of the Authority. No assignment of the contract shall be valid unless it shall contain a provision that the funds to be paid to the Assignee under the assignment are subject to prior lien for services rendered or materials furnished for the performance of the work called for in the contract in favor of all persons, firms or corporations rendering such services or supplying such materials. Such provision, however, need not be inserted if the assignment

SECTION 4 - ASSIGNMENT OF CONTRACT BY CONTRACTOR (Cont'd.)

technically constitutes a novation, i.e., the Assignee not only acquires the benefits under the Contract, but also assumes the obligations thereunder in place of the Assignor.

SECTION 5 - SUBCONTRACTING

For Guarantee provisions of subcontracted items see Detail Specifications, page 4, Section 1.04.

SECTION 6 - RESPONSIBILITY OF CONTRACTOR

The Contractor shall be responsible for the entire work until completed and accepted by the Authority. The Authority will not recognize any parties engaged on the work covered by the contract other than the Contractor and his employees.

The Contractor shall not assign by power of attorney or otherwise, any monies that may become due through the performance of work under the contract, except as hereinbefore provided in Section 4.

SECTION 7 - PATENTS

The Contractor agrees that he will promptly assume the defense of any and all claims, suits or actions which are threatened or instituted against Chicago Transit Board or Chicago Transit Authority or its officers or agents, or Trustee, with respect to the use under these specifications of any patented device, process, apparatus, design, substance, material, method, object or invention whatsoever as soon as the Contractor is notified of such claim, suit or action.

The Contractor agrees to indemnify, save and keep harmless, and severally or jointly or severally, the Authority and its agents, officials and employees, respectively, against all liabilities, judgments, loss, costs, damages and expenses which may in anywise accrue against the Authority or its agents, officials and employees, and Trustee, respectively, by reason of the use or of any claim of the use of any patented material, design, machinery, device, equipment or process furnished or used in the performance of the work under this contract, or by reason of the use of any patented material, design, machinery, device, equipment or process furnished by the Contractor and accepted by the Authority.

SECTION 8 - CONTRACTOR'S LIABILITY

The Contractor shall indemnify, keep and save harmless the Authority, its agents, officials, and employees against all suits or claims that may be based on any injury to persons or property and that may occur, or that may be alleged to have occurred, in the course of the performance of this contract by the Contractor, whether or not it shall be claimed that the injury was caused through a negligent act or omission of the Contractor or his employees; and the Contractor shall, at his own expense, defend any and all such actions, and shall at his own expense pay all charges of attorneys and all costs and other expenses arising therefrom or incurred in connection therewith; and, if any judgment shall be rendered against the Authority in any such action, the Contractor shall at his own expense satisfy and discharge the same.

SECTION 9 - PAYMENT

The Contractor shall receive payment in cash by one or the other of the following two means as set forth in the Contractor's bid proposal and accepted by the Authority.

(1) The contract price for each completed two cars, semi-permanently coupled together, when delivered to and accepted by the Authority. Acceptance may be made before the said two cars are placed in operation by the Authority, or the act of placing the said two cars in operation by the Authority shall constitute acceptance thereof.

(2) Progress payments for work performed or material acquired by the Contractor or his subcontractors on cars being assembled and completed in accordance with these specifications; such progress payments to be made in accordance with the following:

> (a) If and to the extent that progress payments are provided for, the Authority shall make monthly progress payments to the Contractor for work actually performed or for such material as has been received to be applied to the assembly and completion of said cars by him, on the basis of a duly certified and approved estimate of the work so performed, or material so received. The Authority will retain ten (10) percent of the amount of each such estimate, until the delivery and acceptance of completed two cars, semi-permanently coupled together, when the ten (10) percent applicable to such cars delivered and accepted will be paid by the Authority to the Contractor. Such approval by the Authority to be subject to such examination of records relating to work performed and physical examination of material received by the Contractor in the assembly and completion of the cars called for by these specifications.
>
> (b) The Contractor shall furnish a performance bond in favor of the Authority under the terms and conditions set forth in Section 3 of these General Specifications.

SECTION 9 - PAYMENT (Cont'd.)

(2) (Cont'd.)

(c) For the purpose of determining the amount of any such progress payment, a schedule of the items consisting of either or both labor and material involved in the total contract, together with a breakdown of the total contract price between such items, shall be prepared and agreed upon by the parties promptly after the award of the contract.

(d) The initial schedule of items, the allocation of prices against each item and the monthly certificates of progress, shall be prepared by the Contractor and shall be subject to review and approval by the Authority. Progress payments, as herein specified, will be made by the Authority within thirty (30) calendar days after each such progress certificate is so submitted.

SECTION 10 - CONVEYANCE OF TITLE

The Authority is providing for the acquisition of passenger carrying Rapid Transit Cars, which are the subject matter of this specification, under its statutory power to acquire equipment through the issuance of Equipment Trust Certificates. Accordingly, the contract referred to herein will provide in substance that title to the equipment shall not be conveyed to or vested in the Authority, but shall be conveyed by the Contractor to and vested in such bank or banks, trust company or trust companies as may be described in such contract or as may be thereafter designated by the Authority, as Trustee for the benefit of the holders of such Chicago Transit Authority Equipment Trust Certificates as may be referred to in such contract by appropriate designation or description or as may be thereafter designated and described by the Authority in writing delivered to the Contractor by the Authority. It is understood that the Equipment Trust Certificates, so to be issued, may consist of one or more series to be appropriately identified and described by the Authority, and that all the equipment, which is the subject matter of this specification, may be provided to be conveyed to and vested in one Trustee, or that title to some of the units of equipment may be conveyed to or vested in one Trustee, and the remainder of the units in one or more other Trustees, and that different numbers or amounts of units may be provided to be conveyed to each such Trustee, all as may be set forth in such contract or as may, pursuant to the terms of such contract, be thereafter designated by the Authority in writing delivered to the Contractor by the Authority. Such contract shall also provide that to the extent that any progress payments are made, title to the undelivered equipment or work performed upon which such progress payments have been made, shall vest in the relevant Trustee or Trustees to the extent and amount of such payments so made.

SECTION 11 - ASSIGNMENT OF CONTRACT BY AUTHORITY

The Authority may transfer, assign, or otherwise dispose of any of its rights under this contract to a Trustee, as designated by the Authority, before or after delivery by the Contractor of any of the equipment covered hereby, but no such assignment shall impose on any Trustee any of the obligations of the Authority hereunder; and notwithstanding any such assignment or acceptance thereof by said Trustee, such Trustee shall not be or become obligated to the Contractor for or in respect of any matter or thing under this contract, and this contract shall not, nor shall any of its provisions, be enforceable against said Trustee by or on behalf of the Contractor, it being understood that the right, obligation and duty of said Trustee to accept and pay for said equipment shall be and remain only as provided for in, and in accordance with the terms and conditions of the said Equipment Trust Agreement.

SECTION 12 - RIGHTS OF AUTHORITY AND TRUSTEE UNDER INDEMNITY

The protection and indemnity provided to be given by the Contractor under Sections 7 and 8 of these General Specifications shall also inure to and be for the benefit of the Trustee as their respective interests may appear.

Notwithstanding any assignment of the contract by the Authority to a Trustee, and notwithstanding any conveyance of title to the equipment to a Trustee, any and all liabilities of or claims or demands against the Contractor arising out of said Sections 7 and 8 of these General Specifications, or under any warranty or guaranty by the Contractor of materials and workmanship, whether provided for in these General Specifications or in the Detail Specifications, shall continue to be and remain enforceable by the Authority either alone or jointly with the said Trustee, or by any Trustee, either alone or jointly with the Authority.

SECTION 13 - ADDITIONAL OR OMITTED WORK

The Engineer and the Contractor will mutually agree when it is necessary to make changes in, additions to, or deductions from the work to be performed or the material to be furnished pursuant to the provisions of the contract or any other Contract Documents.

Adjustments, if any, in the amounts to be paid to the Contractor by reason of any such change, addition or deduction shall be determined by one or more of the following methods:

(a) By unit prices contained in the Contractor's original bid and incorporated in the contract.

SECTION 13 - ADDITIONAL OR OMITTED WORK (Cont'd.)

(b) By a supplemental schedule of prices if contained in the Contractor's original bid and incorporated in the contract.

(c) By an acceptable lump sum or unit price proposal from the Contractor.

(d) On a cost-plus-limited basis not to exceed a specified limit. A cost-plus-limited basis is defined as the cost of labor, materials, and insurance, plus fifteen (15) percent of the said cost to cover superintendence, general expense, social security tax and profit.

(e) In the event that any material is omitted, by written order of the Engineer, which material has been called for in accordance with the specifications or drawings, and said material has been completed or worked upon to such a degree that it is of no value except for its intended use, then the Contractor shall be paid for such omitted material only the actual cost of labor and material to the Contractor with a fifteen (15) percent of such cost added thereto less a fair scrap value, all as shall be negotiated between the Engineer and the Contractor.

No claim for an addition to the contract sum shall be valid unless agreed upon and authorized by the Authority in accordance with the aforesaid.

The written order of the Engineer to the Contractor to perform any extra work therein mentioned, and the written notices and statements of the work performed hereinabove and hereinafter required from said Contractor are conditions precedent to any recovery on the part of said Contractor for any extra work performed.

In all cases of question or dispute arising or growing out of the contract in any way regarding the cost or value of extras, cost of changes, additions, deductions, variations, allowances, or material to be furnished, and also, the amount of damages in any manner growing out of the violation of any of the provisions of the contract where the Engineer and the Contractor cannot agree, both the Contractor and the Engineer will present their case to the Transit Board for review and decision. The Contractor, if requested, shall exhibit to the Board the actual bills for all materials used and the payrolls of all labor furnished in performing such extra work and if required by the Board, shall certify by his affidavit to the correctness of the amount paid for material and labor shown.

SECTION 14 - DEFECTIVE OR DAMAGED WORK

Any material or equipment used in the assembly and completion of cars described in these specifications found to be damaged or defective at any time before final acceptance by the Authority of said cars shall be repaired, replaced or corrected by the Contractor hereunder without additional cost to the Authority.

If the Contractor shall fail to comply promptly with any order of the Engineer to repair, replace or correct damaged or defective work, then the Authority shall, upon written notice to the Contractor, deduct the cost thereof from any compensation due or to become due the Contractor.

SECTION 15 - POWERS OF THE ENGINEER

Workmanship shall require approval of the Engineer. The Engineer shall have full power to reject or condemn any material furnished or work performed, under the contract, which does not conform to the terms and conditions set forth in the Contract Documents.

SECTION 16 - SPECIFICATIONS AND PLANS

The specifications and drawings are intended to cover complete Rapid Transit Cars. It is not the intent to give every detail in the Specifications and drawings, and it is agreed that the Contractor shall do all the work and furnish all the material which might be required to furnish a complete Rapid Transit Car according to the requirements and intent of these documents. The Authority will not be responsible for the absence of any detail the Contractor may require, or for any special work, equipment, material or labor which may be found necessary as the work progresses.

The Authority reserves the right to make any changes in the specifications and drawings which the Contractor and Engineer mutually agree become necessary either before or after beginning any work under the contract.

Conditions may require that minor changes be made in the fabrication and assembly of the materials and equipment to be furnished and other work to be performed under the contract; and the Contractor, when ordered by the Engineer, shall make such minor adjustments and changes in said work as may be necessary without additional charge, provided such adjustments and changes do not alter the character, quantity or cost of the work as a whole, and provided further that drawings and specifications showing such adjustments and changes are furnished the Contractor by the Authority within a reasonable time before any work involving such adjustments and changes is begun. The cost of major changes, alterations, additions or deductions will be computed for payment purposes as specified in Section 13 hereof.

SECTION 17 - SHOP PLANS AND WORKING DRAWINGS

The Contractor shall furnish to the Engineer such prints, catalogues and other data as the Engineer may require for the work involved under this contract. It is understood and agreed that the Contractor shall furnish sufficient prints and information to permit the Engineer to identify and check the construction and assembly of the various materials and parts of equipment and to determine that the work complies with the requirements of the drawings and specifications.

Approval of the Contractor's drawings by the Engineer shall not relieve the Contractor of full responsibility for furnishing and delivering the materials and equipment in accordance with the provisions of the Contract Documents.

Prior to the issuance of the "Certificate of Acceptance of Rapid Transit Car" (Chicago Transit Authority Form No. 6573, latest revision) by the Authority, for the first coupled Rapid Transit Cars delivered, the Contractor shall furnish to the Authority, records, prints, catalogues, and service manuals in such number as the Engineer may specify.

SECTION 18 - INSPECTION

All material and equipment furnished under the contract shall be new, and shall be subjected at all times during manufacture, fabrication and construction to such inspection and tests by the Engineer as will give due assurance that the terms of the specifications are being complied with in all respects. The authorized representative of the Engineer shall have free access at all times to that part of any manufacturer's plant where the work under this contract is being performed. Where inspection or tests are to be made at a point other than the Contractor's plant, the Contractor shall, in all cases, notify the Engineer, in writing, at least five days in advance to permit such inspection and tests to be performed before shipment is made and shall furnish to the Engineer three copies of all notices for inspection and of all shop orders to facilitate the identification of the material to be inspected or tested.

All inspection and testing of materials, equipment and apparatus furnished under the contract will be performed by the Engineer or his duly authorized inspection engineers or inspection bureaus without cost to the Contractor except as otherwise expressly specified in the Contract Documents.

All samples for analyses and tests shall be taken in such manner as to be truly representative of the entire lot under test and shall not be worked on in any way to alter the quality before testing. Where expressly permitted by the Engineer, in the case of materials taken from stock or for use in minor parts, certified analyses and tests of the manufacturer, furnished in triplicate, may be accepted in lieu of tests. In case the records of physical and chemical tests of stock materials are not available, the results of a reasonable number of tests shall be furnished to the Engineer free of charge as required by the Engineer to satisfy him as to their qualities.

SECTION 18 - INSPECTION (Cont'd.)

Inspection and tests of fabricated parts and manufactured articles shall be made by such methods and at such times as will insure compliance with the specifications in all respects. Inspection of all metal work shall be made before painting.

Should the preparation of the material be at far distant or inaccessible points, or should it be divided into unreasonably small quantities, or widely distributed to an unreasonable extent, or should the percentage of rejected material be unreasonably large, the additional cost of extra inspection resulting therefrom shall be borne by the Contractor, the Engineer being sole judge of what is to be deemed extra inspection.

The Engineer shall have full power to reject any and all material or equipment which fails to meet the terms of the specifications and such material or equipment shall be promptly removed from the work under the contract. All material or equipment which develops defects prior to final acceptance of the vehicle shall be removed and replaced notwithstanding that it may have passed the prescribed inspection and tests.

When each Rapid Transit Car is completed and ready for shipment the Engineer will make an inspection and sign a certificate which will state that the Rapid Transit Car has been completed according to the requirements of the Contract Documents and authorizes shipment. The Contractor will place each Rapid Transit Car on a hoist or over a suitable pit in order that the underfloor equipment might be inspected. The Rapid Transit Car will not be finally accepted until received by the Authority, given a final inspection and found to be in acceptable operating condition. Then a "Certificate of Acceptance of Rapid Transit Car", (Chicago Transit Authority Form No. 6573, latest revision) shall be executed accepting the two cars, semi-permanently connected together, and authorizing payment.

SECTION 19 - NOTICE TO SUSPEND WORK

The Contractor shall delay or suspend the progress of the work, or any part thereof, whenever he shall be so required by written order of the Authority, and for such reasonable periods of time as the Authority may order, provided that in the event of such delay or delays or of such suspension or suspensions of the progress of the work or any part thereof, the time for completion of the work so suspended or of work delayed by such suspension or suspensions, shall be extended for a period equivalent to the time lost by reason of such suspension or suspensions, but such order of the Authority shall not otherwise modify or invalidate in any way any of the provisions of the contract, and the Contractor shall not be entitled to any damages or compensation, except as hereinafter specified in Section 20 of these General Specifications on account of such delay or delays, suspension or suspensions.

SECTION 20 - UNAVOIDABLE DELAY

Should the Contractor be obstructed or delayed in the commencement, prosecution or completion of the work under the contract by any act or delay of the Authority or by riot, insurrection, war, pestilence, fire, lightning, earthquake, cyclone, strikes or through delays or defaults of other parties under contract with the Authority (which delays or defaults were not expressly contemplated in the provisions of the Contract Documents), or due to delays in obtaining the specified materials or equipment for said work or to other causes, which causes or delays the Authority shall determine to be entirely beyond the control of the Contractor, then the times fixed for the completion of the work to the extent specified shall be extended for a period equivalent to the time lost by reason of any of the aforesaid causes mentioned in this Section 20. No such allowance of time shall be made, however, unless notice in writing of a claim therefor is presented to the Authority before the last day of each calendar month for all delays occurring within said calendar month, and the Contractor shall satisfy the Authority that the delays so claimed were unavoidable, caused substantial cessation of work under the contract and could not have been reasonably anticipated or adequately guarded against.

The Contractor shall not be entitled to any damages or compensation on account of any delay or delays resulting from any of the causes set forth in the first paragraph of this Section 20, or on account of delay or delays caused by the Authority, except compensation for extra premiums paid by the Contractor on his Workmen's Compensation bond and insurance and for wages and salaries of employees and other extra expenses of the Contractor that in the opinion of the Authority are necessary only for the proper storage and protection of materials and equipment prepared or in process of being prepared by the Contractor exclusively for use in this Contract. The Contractor shall submit a detailed statement of such extra costs to the Authority.

CHICAGO TRANSIT AUTHORITY

DETAIL SPECIFICATIONS

FOR

RAPID TRANSIT

ELEVATED-SUBWAY PASSENGER MOTOR CARS

SPECIFICATION NO. RRE-3000-63

PAGES 1 to 92

CHICAGO TRANSIT AUTHORITY

DETAIL SPECIFICATIONS
FOR
RAPID TRANSIT
ELEVATED-SUBWAY PASSENGER MOTOR CARS

SPECIFICATION NO. RRE-3000-63

Sec. 1 - Definitions, Scope, Inspections and Tests

1.01 - Definition of Terms As Used In These Specifications

For the definition of terms as used in these Detail Specifications, see Section 2 of the General Specifications.

1.02 - Scope and Purpose

(a) These specifications are intended to cover a general description of light-weight, all-electric Rapid Transit passenger motor cars, including equipment, for operation in trains of from two to ten cars, in multiples of two-car, semi-permanently coupled units, completely tested and ready for operation when accepted by the Company. Cars furnished under this specification shall mechanically couple with Chicago Transit Authority's P.C.C. 6000 class cars.

(b) These specifications are intended to cover all labor, tools, materials, parts, apparatus and equipment (except as otherwise specifically noted herein or stated in writing by the Company) required for the construction and assembly of the number of cars indicated in the Company's accompanying inquiry.

(c) All approvals and changes under this Specification shall be made by the Chicago Transit Authority's Engineer by a "Written Order."

Sec. 1 - Definitions, Scope, Inspections and Tests (Cont'd.)

1.03 - Responsibilities of Car Builder, Truck Builder and Manufacturers

(a) It is understood that the Car Builder shall do all work necessary for the detailed design of the car and prepare all necessary detail drawings. He shall submit all assembly prints and schedules of equipment, materials and specialties to the Engineer for approval before ordering or manufacturing any parts. It is understood that the approval of the Engineer does not in any way relieve the Car Builder of responsibility for the adequacy of the design.

(b) The car body, trucks and equipment supplied must be of the best engineered design for the service intended. The Car Builder shall use his best judgment and experience in determining the stresses imposed by the type of operation described and, in the structure and equipment he supplies, he shall provide for these stresses with an adequate margin of safety. In the selection of the type of material to be used, the Car Builder shall be guided by the desire to obtain the maximum strength and reliability with the minimum weight which is obtainable at reasonable cost.

(c) Each item of equipment or apparatus, including trucks, and the completely equipped car body furnished under this Specification shall be designed and built strictly in accordance with the requirements as stated herein.

(d) The Car Builder shall furnish all labor, tools and materials, parts and apparatus necessary for constructing a complete car, which shall cover all apparatus and materials specified, including trucks, motors, brake equipment, control and other electrical equipment, heating and ventilating equipment and lighting equipment. In addition, the Car Builder shall assume responsibility for the proper working and fitting together of all parts and specialties with necessary clearances, for successful operation.

(e) The Truck Assembler shall furnish all labor, tools and materials necessary to construct the trucks in accordance with these Specifications, and to install therein or assemble therewith, all apparatus and parts to be mounted on said trucks, including wheels, motors, and brake equipment, ready for installation under the car.

Sec. 1 - Definitions, Scope, Inspections and Tests (Cont'd.)

1.03 - Responsibilities of Car Builder, Truck Builder and Manufacturer (Cont'd.)

(f) Each Manufacturer of equipment, apparatus or parts shall provide all labor, tools and materials necessary to make, assemble and completely test, ready for installation by the Car Builder or Truck Builder, as the case may be, the equipment or apparatus to be furnished by said Manufacturer. Certain drawings covering various items of equipment and parts are included herein for the convenience of the interested parties, but are not necessarily complete.

(g) Manufacturers of all materials, apparatus and parts shall co-operate to the fullest extent with the Car Builder or Truck Builder, as the case may be, during design and construction, to insure proper use or installation of their products. They shall give prompt notice to the Company if the use or installation proposed by the Builder is not satisfactory to them.

(h) It shall be specifically understood that the omission of any drawing, schedule, part or item from these Specifications which is required to make the car complete and suitable for the successful performance of its intended functions shall not relieve the Manufacturer or Builder from furnishing the required items or parts under these Specifications.

(i) The Car Builder shall furnish the Transit Authority, immediately following completion of the Contract, two complete sets of all prints of the latest revision, parts lists and bills of material as used in building this order of cars.

All prints shall be furnished accordion folded 8-1/2 inches by 11 inches - 13 inches, with title and drawing number outside, ready for filing.

(j) The Car Builder shall construct, after the award of Contract, a 1/8 scale model of the underfloor of the car showing the location and arrangement of underfloor equipment, piping, conduit and any other equipment as specified or required by these Specifications. The model shall be inspected and approved by the Engineer.

(k) The Car Builder shall construct, after the award of Contract, a full scale mockup of the motorman's cab showing the location of and arrangement of the motorman's controls, switches, seat, front and side windows, cab door, cab heater and any other cab equipment as specified or required by these Specifications. The mockup shall be inspected and approved by the Engineer.

Sec. 1 - Definitions, Scope, Inspections and Tests (Cont'd.)

1.03 - Responsibilities of Car Builder, Truck Builder and Manufacturer (Cont'd.)

(l) The Car Builder shall submit, after the award of Contract, a complete summary of the stress analyses of the car body structure and trucks to show compliance with the strength level requirements herein specified.

1.04 - Guarantees

(a) The Car Builder shall be responsible for all material and workmanship, including all specialties and accessories, used in the construction and assembly of the car and the proper and adequate installation and connecting up of all the equipment and apparatus. He shall replace any material and equipment and make good any workmanship furnished by him that proves defective or inadequate within a period of twelve months from date of acceptance of the vehicle by Chicago Transit Authority. This shall include not only material but also the cost of transportation of material to and from the Builder's plant, or other locations designated by the Builder, and labor required in the removal of the defective parts and replacement thereof.

(b) Whenever under these Specifications the Builder or Manufacturer desires to offer substitute products for those named herein, in accordance with the opportunity afforded by the term "or equal", he shall submit a complete list of all such items and shall obtain approval in writing from the Company for such substitutions before opening of bids. The Company may require the submission of samples for inspection and test, and/or special guarantee as a condition to acceptance of any or all such proposed substitutes.

1.05 - Changes

(a) No departure shall be made from these Specifications, nor any change made in material, design or selection of equipment approved hereunder, without written approval of the Company. Any changes which are authorized during the progress of the design or construction shall be made promptly by the Car Builder, Truck Builder or Manufacturer as the case may be. Any change shall be incorporated in each car shipped after effective date of change.

(b) It shall be agreed upon in writing before proceeding with any such change, and should it affect the price of the completed cars, the price shall be adjusted upward or downward accordingly at the time the change is agreed upon.

Sec. 1 - Definitions, Scope, Inspections and Tests (Cont'd.)

1.06 - Inspections

(a) Authorized representatives of the Company shall have access at all times to those parts of the plants of the Car Builder, Truck Builder, and Manufacturers concerned with supplying material or parts for these cars, for the purpose of inspecting materials and workmanship during the progress of the work.

(b) Car and Truck Builders and Manufacturers shall extend to the Company's representative full co-operation and necessary facilities to permit the convenient inspection of all materials, work and equipment supplied hereunder. This shall include providing desk space, copies of all drawings, diagrams and data which may be needed to properly inspect and check the design, construction, assembly, installation, workmanship, clearance, tolerance and operation of the cars, trucks, equipment and parts thereof supplied hereunder. At the Car Builder's plant, or at other approved locations, a suitable means shall be provided to permit inspection and testing of all parts and equipment.

(c) The presence of the Company's representatives in the plant of the Manufacturer or Builder shall not in any manner lessen the responsibility of said Manufacturer or Builder in respect to meeting all requirements of these Specifications. The Company shall have the right to reject all material and workmanship which does not fully conform to these Specifications or to accepted practices.

(d) If the Company shall have reasonable evidence that defective work has been permitted by a Builder or Manufacturer, or that defective materials have been used, then an examination shall be made on work partly or fully completed. The Builder shall arrange to furnish the appliances and labor for making such investigation and inspection as may be required by the Company. Any imperfect construction or materials which may be disclosed shall be promptly corrected by the Builder or Manufacturer. If investigation discloses no defect, the expense of such investigation, if substantial, may be negotiated between the Company and Builder.

(e) All work of whatever kind on these cars, and all parts and equipment thereof, which during the progress of construction shall become damaged from any cause whatsoever, shall be made acceptable to the Engineer at the expense of the Builder or Manufacturer in whose plant the damage occurs.

(f) Material, equipment, and apparatus which have been inspected and accepted by the Company shall be marked or stored so that they can be readily identified.

Sec. 1 - Definitions, Scope, Inspections and Tests (Cont'd.)

1.06 - Inspections (Cont'd.)

(g) Material or equipment intended for use on these cars or the parts thereof which shall be rejected by the Company as unusable, or not in conformity with these Specifications, shall be clearly marked and so disposed of as to assure that it will not be used or offered for use again on these cars, unless reworked and accepted by the Engineer. If reworking is impossible, proper material or equipment shall be substituted without delay.

1.07 - Tests and Adjustments

(a) Facilities and Adjustments

(1) The Car Builder shall use a suitable level test track of proper gauge, length, and alignment, to attain a car speed of at least 20 mph to permit the acceleration and deceleration and other operating tests described in these Specifications. The tests at the aforementioned speed does not relieve the Builder of the responsibility for all performance requirements. This track shall be equipped with suitable means providing not less than 550 volts dc potential measured at the car during full acceleration. The cars shall not be accepted by the Engineer until such tests are successfully completed.

(2) All working and moving parts, and all operating devices and controls of each car and its equipment, shall be tested and put in proper operating condition by the Car Builder and approved by the Engineer before cars are accepted. The Car Builder shall perform or arrange to be performed, as called for in these Specifications, all of the tests and adjustments specified herein.

(b) Car Wiring Tests

It is understood that in the following tests the Builder shall follow the instructions of the electrical Manufacturer in the special requirements of protecting and testing all solid state components or rotating equipment.

(1) Ring out all wiring circuits to insure proper continuity and polarity after assembly and installation of all equipment.

(2) Make a direct current ground insulation test on each car as follows: (a) disconnect all ground wires; (b) disconnect the storage battery at its terminals; (c) remove, or short-circuit all semi-conductors; (d) connect all circuits together and then connect to a 600 volt dc source through an approved voltmeter. If this test shows freedom from ground connection, the ac test as described hereafter shall be applied. If the dc test does not show freedom from ground connection, the point or points at which such ground occurs shall be determined and the insulation made satisfactory to the Engineer before the ac test is applied.

Sec. 1 - Definitions, Scope, Inspections and Tests (Cont'd.)

1.07 - Tests and Adjustments (Cont'd.)

(b) Car Wiring Tests (Cont'd.)

(3) Make an alternating current ground insulation tests on each car after separating the connection between the nominal 600 volt dc circuits from the nominal 40 volt dc circuits and the alternator circuits, if a motor-alternator set is used. Apply for one minute a potential of 800 volts ac to all 40 volt dc circuits alone, including the alternator field. Also apply a potential of 1200 volts ac to the alternator circuits, including the alternator stator windings. Apply for one minute a potential of 2200 volts ac to all 600 volt dc circuits alone, and 1870 volts ac to the 600 volt dc apparatus, with the motor of the motor-alternator set connected in the circuit. In each case a circuit breaker set to open with a current slightly greater than the charging current shall be connected in series. If this circuit breaker remains closed, the insulation to ground shall be considered satisfactory.

All wires, cables and/or equipment that do not meet the requirements of the test shall be removed and replaced by the Car Builder. After replacement of any such defective parts, materials or equipment, the car shall be retested.

(4) Reconnect the ground connection and storage battery, replace semiconductors or remove all short circuits, and then test all 40 volt dc circuits, all alternator circuits, if alternator is used, and all 600 volt dc circuits on each car for proper functioning.

(c) Motor and Brake Controller

(1) Without the motor current, test the propulsion motor controllers of the car for correct sequence of operation by operating each master controller through the power cycles and observing the functioning of the various pieces of equipment involved. Rectify any failure to function in proper sequence before proceeding with the remaining tests.

(2) Without the motor current, operate each controller through the braking cycle and check functioning of brake equipment for both proper sequence and the relationships between the braking media.

(d) Friction Brakes

(1) After adjusting the potential of the 40 volt dc power supply on each car to the specified range, adjust the friction brake so that, when used alone, a rate of 3.2 mphps deceleration shall be attained with a light car when the master controller is placed in the No. 3 brake position.

Sec. 1 - Definitions, Scope, Inspections and Tests (Cont'd.)

1.07 - Tests and Adjustments (Cont'd.)

(e) Track Brakes

(1) Adjust the height of the magnetic track brake shoes above the rail to 3/8 inch for each truck, if used.

(f) Car Performance Tests

(1) On each car, make acceleration tests over the test track with a recording accelerometer, an indicating ammeter in the main motor circuits, and an indicating voltmeter across the motor circuit. If adjustments are required to obtain the current values corresponding to the rates of acceleration specified in Section 10.03 (a), these adjustments shall be made by a representative of the electrical equipment Manufacturer.

(2) On each car make deceleration tests over the test track with a recording accelerometer, and with indicating ammeter to measure dynamic brake current. Make all necessary adjustments to obtain proper synchronization of the various forms of braking and the rates of deceleration specified in Section 10.03 (a). If adjustments of the dynamic brake control should be found necessary, these adjustments shall be made by a representative of the electrical equipment Manufacturer.

(3) All performance characteristics shall comply with the requirements of these Specifications and shall be held within such limitations as to prevent undue surging in train operation. If the car or any equipment fails to satisfy these objectives, the necessary adjustments shall be made and the car shall be subjected to retest as directed by the Company. Acceleration and braking rates specified refer to completed car without passenger load. Recorded accelerometer charts shall become the property of the Company.

(g) Miscellaneous Body Tests and Adjustments

(1) Prior to shipment of any cars to the Company, a check shall be made on an "A" and "B" car, to determine truck clearance on a curve having a radius as specified in Section 2.02 (b). This shall be done by running the car around a curve of that radius or by other approved equivalent means. Check drawbars for proper swing, and for clearance on curve. Check all swing cables for proper clearance on curve specified in Section 2.02 (b). All curve tests shall be made with load equal to 150 passengers.

Sec. 1 - Definitions, Scope, Inspections and Tests (Cont'd.)

1.07 - Tests and Adjustments (Cont'd.)

(g) Miscellaneous Body Tests and Adjustments (Cont'd.)

(2) Roof shall be water tested after fabrication and before installation on car and again after car is completed. With ventilating fans running at full speed drawing air in, with dampers open, if used; test roof, doors and windows on each car for weather tightness, while car is being subjected to continuous spray from suitably located nozzles so that the car is completely covered with sprayed water. The pressure of the water during the test shall be approximately 45 psi at the nozzle. This test shall be continued long enough to enable inspection to be made of the car for determining location of any leaks. All leaks found during the test shall be corrected by the Builder to the satisfaction of the Engineer.

(3) Check and adjust the doors and their operating mechanism on each car to assure smooth operation of doors, interlocks and door signals.

(4) Adjust the headlight of each car so that the center of the beam strikes the right hand rail 75 feet in front of the car.

(5) Check heating and ventilating controls on each car to give the desired functions as specified in Section 7.02 and for even distribution and proper volume of heat.

1.08 - General

(a) Approval

All pieces of equipment, apparatus, parts, accessories, and specialty items, which shall be component parts of these cars, shall require approval of the Engineer prior to bid openings.

Each bidder, as soon as he has determined what apparatus, parts, accessories and specialty items he proposes to furnish, shall give the Engineer sufficient information so that he can determine exactly what is being offered for approval.

Sec. 1 - Definitions, Scope, Inspections and Tests (Cont'd.)

1.08 - General (Cont'd.)

(b) Delivery

The Car Builder shall state, as part of his proposal, the number of calendar days, after date of being awarded the Contract, that he shall require to start delivery of the cars, the average number of cars he shall deliver each week and the total number of calendar days after date of being awarded the Contract which he shall require to complete delivery of all cars. All cars shall be shipped within seventeen months of the date of awarding the Contract. For delay in delivery of any said cars over and beyond the seventeen months period as previously specified, the Car Builder shall pay the Chicago Transit Authority $250.00 for each and every calendar day until all cars have been delivered.

(c) Ownership Plates

Chicago Transit Authority will supply the Car Builder with "Ownership Plates" which the Car Builder shall permanently affix to the outside of the body of the cars, one on each side, the exact locations of which the Engineer will advise the Car Builder. These "Ownership Plates" shall be affixed at the Car Builder's plant before delivery of the cars. Plates shall be installed after the exterior painting is completed, if the bodies require painting.

Sec. 2 - Dimensions, Weights and Drawings

2.01 - General

(a) The dimensions and estimated weights shall be as follows, and as shown on Company drawings.

2.02 - Dimensions and Design Considerations

(a) Length of car on centerline over anti-climbers	48 feet, 0 inches
Length of two-car unit over drawbar faces	96 feet, 6 inches
Distance center to center of trucks	33 feet, 8 inches
Track Gauge	4 feet, 8-1/2 inches

Sec. 2 - Dimensions, Weights and Drawings (Cont'd.)

2.02 - Dimensions and Design Considerations (Cont'd.)

(a) (Cont'd.)

Truck wheel base (maximum)	6 feet, 6 inches
Width of car over side sheathing at belt rail (maximum)	9 feet, 4 inches
Width of car body at top of floor (maximum)	8 feet, 8 inches
Width of car at corner posts (maximum)	8 feet, 8 inches
Height of light car from top of rail, not to exceed	12 feet, 0 inches
Height of car floor from top of rail at side door opening, light car	3 feet, 9-5/8 inches
Height of center line of coupler face from top of rail, light car	2 feet, 3-3/8 inches
Maximum number of cars per train	10
Number of seated passengers, "A" Car	47
Number of seated passengers, "B" Car	51

(b) Curve Limitations

Radius of shortest lateral curve	85 feet, 0 inches

Radius of shortest vertical curve: Cars shall negotiate vertical curves where the horizontal center line of the coupler head tilts either 4 degrees above or below the horizontal center line of the coupled heads on level track.

Cars shall also operate separately up a 10 percent grade ramp, 8 feet, 7-1/2 inches long, onto a transfer table where one truck is on the level and the other is on the ramp.

2.03 - Weights

(a) The maximum allowable weights, shall be as follows:

Light Weight, Without Air Conditioning	45,000 lbs.
Passenger Weight	22,500 lbs.
Loaded Weight	67,500 lbs.

Sec. 2 - Dimensions, Weights and Drawings (Cont'd.)

2.03 - Weights (Cont'd.)

(b) The Car Builder shall furnish with his bid an estimated weight of the complete car, itemized to show the individual weights of the principal components in "A" and "B" cars, consisting of car body shell, seating, forced ventilation, electrical propulsion controls, drawbar and coupling equipment, and trucks.

(c) The Car Builder shall transmit to the Company a record of the weights of complete car bodies, and of complete trucks, with a sufficient number of different bodies and trucks being weighed to establish a reliable average. In addition, the certified and witnessed weight slip of each car complete, ready for shipment, shall be furnished.

2.04 - List of Drawings

The following drawings shall be a part of these Specifications:

Drawing No.	Title
RS-5058	Single Passenger Seat (Cab End)
RS-5061	28 Inch Wheel
RS-5070	Standard Sign Roller
RS-5073	Single Passenger Seat
RS-5092	P.A. Amplifier Dimensions
RS-5095	Standard Numerals
RS-5107	Microphone Box
RS-5115	Standard Safety Springs
RS-5119	Plan and Elevation, Rapid Transit Car
RS-5120	Current Collector Beam Assembly
RS-5121	Current Collector Beam Details
SK. E-11563	Proposed Master Controller Schematic Wiring
SK. E-21563	King Pin and Upper Center Bearing Member
SK. E-30962	Run Number Sign Curtain
SK. E-40661	Rapid Transit Truck
SK. E-41062	Proposed Power Interlock and Emergency Relay Circuits
SK. E-41162	Power Control Relay By-Pass Switch
SK. E-70962	Cone Center Plate for CTA No. 1 Truck
SK. E-92561	Box For Motor Lead Connectors
SK. E-111157	Hand Guard
SK. E-111962	Receptacle for Automatic Interlocking Coil
SK. E-121362	Train 'Phone Wiring Diagram
PCC-12	Wood Trolley Slipper and Bracket
SD-1036	Standard Two-Passenger Seat

Sec. 3 - Car Body

3.01 - General

(a) The car body shall be constructed of steel, stainless steel or steel and aluminum and assembled in conformity with the general arrangement and dimensions shown on the accompanying drawing, Chicago Transit Authority No. RS-5119. The arrangement of the marker lights, headlight, and destination sign shown on Chicago Transit Authority Drawing RS-5119 are subject to the final design as submitted by the Car Builders and subject to the approval of the Engineer. The finished car body sides shall have flush doors, recessed grab handles, gutters, and outside appurtenances, that will be of such design that they will limit projections to minimum dimensions, subject to the approval of the Engineer. Longitudinal corrugations or flutes will be acceptable. Sliding side doors will be acceptable, with protected recessed pockets, free of water, dirt, and snow pockets, and designed to provide protection to the operating mechanisms.

(b) The car body and attached equipment shall be designed to provide necessary clearances for the trucks and cable arrangements.

(c) Two cars semi-permanently coupled together, one designated as the "A" car and the other as the "B" car, shall constitute the basic unit, with an operating cab at the outer ends of each unit. The cars shall be designed for multiple unit operation of from two to ten cars.

(d) The car equipment shall be so arranged that each car, complete with necessary equipment, shall balance as nearly as is practicable. The floor to top of rail height at the four corners of the car shall not vary more than 3/8 inch when mounted on the trucks. The total weight of all "A" cars shall be within 650 pounds of each other; likewise all "B" cars shall weigh within 650 pounds of each other.

(e) The car underframe shall provide ducts with access holes, or troughs for main motor, control and auxiliary wiring.

(f) Car body shall be a welded or riveted structure of steel, stainless steel, or steel and aluminum. The main steel members of a steel and aluminum body or all parts of an all-steel body, other than stainless steel, shall be made of Cor-Ten steel or equal. The front of the No. 1 end of the cars may be sheathed with reinforced fiber glass. Screws or bolts shall be used for removable parts and rivets or lock bolts may be used at locations where welding is impracticable.

(g) The car body structure shall be designed so that jacks may be used for lifting the car at jacking locations along both sides of the car. Jacking reinforcements shall be attached to underside of side sills, and extend from under the full side door openings to the end sills of the car.

Effort should be made to provide clearance between side sills at points approximately 10 ft. 8 in. from each end of the car, to allow use of a beam across the side frames for lifting the car. Equipment should not project lower than side sills at these areas.

Sec. 3 - Car Body (Cont'd.)

3.01 - General (Cont'd.)

(h) The connection between car body and trucks at the king pins shall be such that the trucks will be raised with the car body, unless intentionally detached therefrom.

(i) With maximum passenger load on a minimum curve and with worn wheels, equipment and enclosures which are hung under the car shall have sufficient clearance over running and third rails. Equipment that extends over the third rail on curves shall be at least 12 inches above running rails with light car. With worn wheels, all truck parts, except over the rails, shall be at least 2 inches higher than the running rails.

(j) Water deflecting gutters shall be installed over doors, windows, and ventilation openings as needed.

3.02 - Motorman's Cab and Conductor's Position

(a) A permanent motorman's cab shall be located in the right hand front corner of the car as indicated on Chicago Transit Authority, Drawing RS-5119. This cab shall house the necessary motor control and other equipment for the proper operation of the train. The cab shall be formed by a solid metal or plymetal, melamine coated, partition across the back extending from floor to ceiling and a similar short section at the side. A door hinged to the end door post shall, in one position, complete the side of the cab for use by the motorman, and in the other position, shall completely enclose the train operating equipment so passengers can use the cab seat. Keepers for the motorman's cab door lock shall provide positive locking of the door in both positions. A switch cabinet, with a hinged door, shall be located at the rear of the motorman's cab to house certain switches and apparatus. The hinged door shall be equipped with a lock operated by Chicago Transit Authority's standard conductor's key. The motorman's cab, partition, door, and cabinet to house switches and apparatus, shall be approved by the Engineer. The thickness of the melamine coating, and selection of patterns in melamine shall be compatible with the material furnished for interior finish of the cars and shall be approved by the Engineer.

(b) The conductor's working area shall be located in one car of each two car unit. This car shall be designated as the "A" car. This area or position shall be the location of the conductor's side door operating controls. A rugged step approximately 8 in. by 20 in. shall be placed along each side wall approximately 12 inches above the floor which will provide a place for the conductor to stand while looking out the side window. The step shall be attached to the side wall without the use of legs or supports down to floor.

Sec. 3 - Car Body (Cont'd.)

3.02 - Motorman's Cab and Conductor's Position (Cont'd.)

(b) (Cont'd.)

Top surface of step shall be covered with a piece of metal backed rubber, to match the floor material, with front tapered nosing, cemented and screwed to the step. The side wall for a distance of 12 inches above the step shall be protected by a piece of 18-8 stainless steel. The seats at the conductor's position shall be as shown on Chicago Transit Authority Plan Drawing, RS-5119. The door operating controls and microphones shall be located as specified by the Engineer.

3.03 - Framing Structure

(a) The car body framing shall be made of metal and be so designed and constructed that it shall carry the required loads and absorb properly the buffing stresses imposed when operating in the services specified without damage to the structure. The sub-frame, roof and side frames shall be considered as a unit in withstanding the cumulated stresses. Stresses in the center of the car, under horizontal loads, shall be 30 percent less than outside the bolsters at the ends of the car. The sub-frame must contain sufficient cross bearers to carry the floor loads to the side frames without excessive flexing of the floor. Wherever the side sills are enclosed at the bottom so as to prevent draining, 1/2 inch drain holes shall be provided to prevent accumulation of moisture. One hole shall be provided under each post, and between the posts.

(b) The side and end frames shall be of a metal approved by the Engineer, and be so designed and constructed that they will carry their proportion of the stresses imposed on them. Special care shall be exercised in the attachment of the sheathing in order to obtain a finished appearance to the exterior surface. The use of non-structural fiber glass polyester plastic for sheathing the end framing shall be acceptable, subject to the approval of the Engineer. Longitudinal corrugated or fluted side sheathing shall be acceptable. Stiffeners shall be installed back of side sheets between posts, if needed, to prevent the side sheets from "oil canning." Proper reinforcements shall be installed around the side entrances in order to transfer the stresses around the openings.

All posts shall be securely welded or riveted to both the underframe and roof structure in order to make the entire car frame act as one unit without any movement at the joinings. The sum of the section modulii of all the end posts at one end of the car shall not be less than thirty and the sum of the section modulii of the two center posts shall be approximately 75 percent of the total of all end posts. If material other than Cor-Ten steel is used, the

Sec. 3 - Car Body (Cont'd.)

3.03 - Framing Structure (Cont'd.)

(b) (Cont'd.)

section modulii shall be inversely proportioned in the ratio of the yield strength of the material to the yield strength of Cor-Ten steel.

All end posts shall be attached to the underframe sills so that, in the event of collision, the sills will crush back before breaking the post connections.

(c) A section of anti-climber shall be attached to the end sill at each end of the car as indicated on the drawings. This may be made of a rolled section or an approved built-up section. The joints of any built-up section must be continuously welded on both sides. The anti-climber shall be vertically in line with the underframe and be securely attached to it by means of a casting or built-up section.

(d) The car shell shall be designed to withstand a static force of 200,000 pounds exerted on the face of the anti-climber without damage to the structure. The force to be applied to an area 4 inches high and 24 inches wide. One of the first five car shells, without interior equipment, shall be statically loaded with the equivalent to equipment and maximum passenger load and squeezed at the anti-climber to 200,000 pounds. Stresses shall be measured at locations approved by the Engineer and records of complete test results shall be furnished to Chicago Transit Authority. Test procedures shall be established, witnessed and approved by the Engineer. All strain gauges shall be applied prior to any static load. Under vertical static load, no measured stress shall exceed 50 percent of yield strength of the material used, and under combined vertical and horizontal load, no measured stress shall exceed 90 percent of the yield strength of the material used.

(e) The Car Builder shall submit an alternate bid on a car body structure design which will begin to yield when 100,000 pounds are applied to the face of the anti-climber. The resistance of the structure shall progressively increase up to 200,000 pounds, at a deformation not exceeding 2 feet. This bid shall include all costs (including the frame destroyed) of testing to determine compliance with these requirements. The frame shall be loaded and strain gauged as described in Section 3.03 (d), in order to determine stress at the yield points.

(f) Each member of the car frame other than stainless steel or aluminum shall be given a heavy coat of primer before assembly as called for in Section 12.09 (b), and the insides of the posts and the side sills shall be given a second coat of an approved rust preventive paint equal in quality and performance to Pratt & Lambert No. 1 Asphaltum varnish after assembly as called for in Section 12.09 (e). Car frame members of aluminum shall be primed as called for in

Sec. 3 - Car Body (Cont'd.)

3.03 - Framing Structure (Cont'd.)

(f) (Cont'd.)

Section 12.09 (b). All posts that are enclosed at the bottom shall be provided with 1/2 inch drain holes to prevent accumulation of water.

3.04 - Bolster

(a) The car body bolster shall be a built-up structure of formed and welded steel plates, carrying a cast steel king pin and center bearing member of P.C.C. type, without groove. The king pin shall be built into the bolster at right angles to the floor. A suitable renewable bushing shall be provided at the lower end of the king pin to compensate for wear. See Chicago Transit Authority Drawing SK. E-21563.

(b) The Car Builder shall provide a Gatke, No. 7184, conical washer, or approved equal, for insertion between the center bearing surfaces.

3.05 - Roof

(a) The carlines and purlines shall be made of steel, stainless steel, or aluminum. Water deflecting gutters shall be installed on the roof arranged to deflect water several inches to the sides of each side door, conductor's side windows, motorman's side window, and ventilating air intake and exhaust openings. The roof sheets shall be attached to the carlines and other structural members in such manner that they shall present a finished appearing surface, and all joints shall be water tight. The roof sheets shall be attached to the carlines and purlines with the use of Huck lock bolts or equal, subject to the rivet Manufacturer's recommendations. Longitudinal corrugated roof sheets will be acceptable. Each finished roof shall be water tested in the presence of the Engineer.

3.06 - Ceiling and Side Lining

(a) Ceiling sheets shall be of an approved melamine faced material, or an approved equivalent material. Battens shall be approved by the Engineer. The ceiling sheets shall not exceed 8 feet in length, and all joints shall occur at carlines. A layer of approved, fire retardant insulation, having insulating properties equal to 2 inches of fiber glass, shall be installed and properly supported under the roof sheets.

(b) The interior side finish from the window sill to the ceiling shall be of an approved melamine faced material or an approved equivalent material, which is compatible with the material furnished in Section 3.06 (a). Battens shall be approved by the Engineer. The interior side finish panels above the window sills shall not exceed 8 feet in length and joints shall occur at posts.

Sec. 3 - Car Body (Cont'd.)

3.06 - Ceiling and Side Lining (Cont'd.)

(c) The interior side finish below the window sills including the ends of the car and in motorman's cab shall be of an approved melamine faced material, or an approved embossed anodized aluminum material, which will be compatible with material as furnished in Section 3.06 (a) and (b). Battens shall be approved by the Engineer. The interior inside panels below the window sills shall not exceed 8 ft. in length and joints shall occur at posts.

(d) A layer of approved, fire retardant insulation, having insulating properties equal to 1 inch of fiber glass, shall be installed and properly supported, between the side sheets and the inside finish, including the ends of the car and in the motorman's cab, from the ceiling to the floor.

Provisions shall be made to protect the insulation at the side door pockets, if sliding doors are furnished.

(e) If ceiling air ducts are provided, they shall be covered with a material compatible with the requirements for material furnished in Section 3.06 (a).

(f) All interior finish sheets, if metal, or metal that is coated, shall be insulated from outside posts.

(g) The ceiling and side lining panels shall be attached in such a manner so as to prevent thermal conductivity through the attaching screws. The procedure shall require the approval of the Engineer.

(h) Samples of inside finish, and ceiling sheets, and battens shall be submitted to the Engineer for approval, before opening of bids.

3.07 - Floor

(a) The floor shall consist of Exterior grade plywood 3/4 inch thick to the underside of which an 0.028 inch thick aluminum plate is securely glued. Plywood material shall be Kopper's cellon treated, or equal, before application of aluminum plate to the plywood. The plywood shall be laid crosswise of the car in strips long enough to extend in one piece from side to side of the car, be securely fastened to the underframe with all joints at cross bearers and have all joints between pieces of plywood, and underframe properly filled with a sealer while being laid. The ends of all pieces at the sides of the car shall be sealed before laying to make them impervious to moisture. The top of the entire plywood floor shall be sanded smooth and level before laying the floor covering. Floors constructed of any material other than plywood shall have the approval of the Engineer. The underside of the floor shall be sound deadened and insulated with an approved insulation equal to 1 inch of fiber glass.

Sec. 3 - Car Body (Cont'd.)

3.07 - Floor (Cont'd.)

(b) The floor covering shall consist of an approved, non-skid, long life, rubber composition material, equal in quality and performance to Rub-Bub, laid as per Manufacturer's recommendations in pieces as follows:

One piece approximately 30 inches wide, 3/16 inch thick, with a ribbed top surface shall be laid as an aisle strip from end door to end door and have ribs running lengthwise of the car. This aisle strip shall be securely cemented to the plywood floor, and be installed so that aisle strip at each end of the car extends under the end door threshold plates.

Between the aisle strip and the sides of the car, except in the area at the side entrances, the floor covering shall be 3/16 inch thick having a smooth top surface and shall be securely cemented to the plywood floor.

If blinker side doors are used, thresholds shall be made of the same ribbed material as the aisle strip, except with 24 ga. 18-8 stainless steel backing. The threshold shall extend down on the outside of the car over the side sheathings, fit tightly against and be screwed to the sheathing and extend into the car 8 inches, to join with the floor material. These pieces shall be cemented with Barrett-Plastic cement or equal, to the lower floor and be held in place by means of screws. The threshold ribs shall run crosswise of the car.

If sliding side doors are used, the threshold arrangement and installation shall require approval of the Engineer.

At the side entrances, between the aisle strip and the threshold pieces, 3/16 inch thick ribbed flooring, shall be laid with the ribs running crosswise of the car and with the ribs registering with the ribs in the threshold pieces.

Both the floor and the floor covering shall be installed in a workmanlike manner, be securely fastened in place, have water-tight fitting joints and have all joints well sealed in order to exclude moisture. Any holes in the floor covering or thresholds which are necessary in securing the covering or thresholds shall be filled with an approved sealer.

Where the floor covering reaches the walls or the car body, it is to be finished with an approved rubber, or approved metal sanitary cove. If molding is used, it shall be sealed and screwed in place in a workmanlike manner. Sanitary corner castings or pressings shall be properly fitted at all corners and suitably sealed.

Sec. 3 - Car Body (Cont'd.)

3.07 - Floor (Cont'd.)

(b) (Cont'd.)

The cement used shall be equal in quality and performance to Minnesota Mining and Manufacturing Company's #EC-1357. Floor covering colors shall be selected by the Engineer before bid openings.

(c) The end door opening at each end of the car shall have a cast aluminum threshold plate having two troughs to collect water that may work under and around the door. One trough shall be under the door itself and the other shall be just inside the door and extend approximately 2 inches beyond the door on each side. Both troughs shall be fitted with adequate drain pipes extending through the underframe but not draining on the draw bar carrier. Threshold plates shall be secured with flathead bolts and nuts.

3.08 - Windows

(a) Passenger's Side Windows: The side windows shall be arranged as shown on Chicago Transit Authority Drawing RS-5119. The side windows shall have a separation, approximately 10 inches down from the top. The upper section shall be hinged at the horizontal mullion to open inward approximately 30 degrees, and be in two sections. The hinging, method of weather sealing, and protective baffles at the ends of each inward open section shall be approved by the Engineer. The small side windows shall be of the same design with an upper inward opening sash in one section. The sash shall have rounded corners and be made of anodized 6063 T4 aluminum, or equal, satin finish, and be reinforced to withstand hard usage. The locking devices and complete sash assemblies shall be approved by the Engineer.

The large fixed section of glass in the side window sash shall be 7/32 inch laminated safety sheet glass, equal in quality and performance to L.O.F. EZ-EYE. The glass in the inward open section of sash shall be 7/32 in. laminated safety sheet glass equal in quality and performance to L.O.F. EZ-EYE, Double Density.

(b) Cab Window: The side sash in the motorman's cab shall be in two sections, the lower section shall be fixed and the upper section arranged to drop outside the lower section. The drop sash shall be fitted with 18-8 stainless steel continuous racks and locks having 18-8 stainless steel latches. Cushions shall be provided at the bottom to soften the blow of dropping the sash. Sash shall be made of anodized 6063 T4 aluminum, or equal, satin finish, and be reinforced to withstand hard usage. Sash shall be equal in

Sec. 3 - Car Body (Cont'd.)

3.08 - Windows (Cont'd.)

(b) (Cont'd.)

quality and performance to Adams and Westlake Drawing WM 3535. Both sash shall be glazed with 7/32 inch laminated safety sheet glass equal in quality and performance to L.O.F. EZ-EYE.

(c) Conductor's Windows: The sash at the conductor's area shall be in two sections, the lower section shall be fixed and the upper section shall be arranged to drop outside the lower section. The upper sash guides shall have stops, made of 18-8 stainless steel, on each side to hold the sash in the closed position, and on one side the guide shall have one stop to hold the sash open one inch. The sash guide with two stops should be provided for left and right hand use as described on Adams and Westlake Drawing WM 3536. Location of sash guides shall be as directed by the Engineer. The drop sash shall be fitted with rubber bumpers to soften the blow of dropping the sash. Sash shall be made of anodized 6063 T4 aluminum, or equal, and be reinforced to withstand hard usage. All sash shall have rounded corners and be equal in quality and performance to Adams and Westlake Drawing WM 3536. Stationary lower sash shall be glazed with 7/32 inch laminated safety sheet glass, equal in quality and performance to L.O.F. EZ-EYE, and upper drop sash shall be glazed with laminated safety sheet glass, 7/32 inch thick, equal in quality and performance to L.O.F. EZ-EYE.

(d) All window sash locks shall be installed with 18-8 stainless steel screws and stainless steel elastic stop nuts.

(e) Sash described in Section 3.08 (a), (b) and (c) may be made of 18-8 stainless steel, if car is made of stainless steel.

(f) The end windows of the No. 1 and No. 2 ends of the car, except the motorman's front window, shall be glazed with 7/32 in. laminated safety sheet glass, equal in quality and performance to L.O.F. EZ-EYE, with the glass set into the end sheets with rubber glazing channels without sash. The motorman's front window shall be glazed with 1/4 in. safety plate glass set into the end sheets with rubber glazing channels without sash.

(g) All sash and guides shall be anodized aluminum, satin finish, or satin finish stainless steel.

3.09 - Seats

(a) General: Each car shall have the number of one and two passenger seats as shown on the Plan and Elevation, Chicago Transit Authority Drawing RS-5119; certain seats as indicated shall have stanchions from seat back to ceiling. The foot plates of all seats shall be fastened to the floor with hexagon head 18-8 stainless steel cap screws. The 18-8 stainless steel screws shall fasten

Sec. 3 - Car Body (Cont'd.)

3.09 - Seats (Cont'd.)

(a) (Cont'd.)

into continuous stringers welded to the underframe, or other approved local tappings. Seats shall have the dimensions shown on the respective drawings.

(b) Two-Passenger Seats: The two-passenger seats shall be made in accordance with Chicago Transit Authority's Drawing No. SD-1036, latest revision and the following specification:

(1) Seat Frame: The seat frame, except where stated otherwise, shall be made of 1 inch diameter, not less than 16 gauge, cold rolled steel tubing. That part of the frame from near the top of the back on the window side, across the top, down the aisle side of the back and around the aisle end of the cushion to a point 6 inches across the front of the cushion, shall be made of 1 inch diameter 16 gauge 18-8 stainless steel tubing. The frame shall have an internal reinforcing member between the horizontal and vertical framework on both the wall and aisle side as shown on Chicago Transit Authority Drawing No. SD-1036, latest revision. Four 18-8 stainless steel lugs shall be welded to the seat frame for attaching the seat back. The seat legs from the horizontal framework to the floor shall be 1 inch diameter 16 gauge 18-8 stainless steel construction as per Chicago Transit Authority's Drawing No. SD-1036, latest revision. Foot plates shall be at least 1/8 inch thick 18-8 stainless steel and shall be welded to the legs from the bottom. All welds in seat frames must be smooth and have a finished appearance.

(2) Seat Back: The seat back shall be flat and be securely fastened to the frame. The front of the seat back at the two ends shall extend 1/2 inch in front of the tubular frame. The back of the seat back shall be covered with a sheet of not less than 0.018 inch thick 18-8 stainless steel having an approved embossed pattern. The frame of the back shall be 3/8 inch fir exterior grade plywood with a vertical or horizontal center strip 2 inches or more wide to keep the seat back metal sheet from being pushed in, or approved equal. This framework shall be adequate to properly support and provide a secure fastening for the metal back, the padding and the covering material. The back shall extend down at least to 1/2 inch of the bottom of the seat cushion. The back filling shall be properly shaped, held in place and designed so that the portion at the top shall be approximately 2-1/4 inches thick tapering to the thickness of the seat covering material at

Sec. 3 - Car Body (Cont'd.)

3.09 - Seats (Cont'd.)

(b) (2) (Cont'd.)

the top of the seat cushion. The seat back shall be held in place in the tubular framework by being fastened to four 18-8 stainless steel lugs welded to the tubular framework. Countersunk stainless steel machine screws shall extend through the seat lugs into the seat back framework, which shall have 1/4 inch thick or heavier tapping plates, or approved "T" lock nuts.

(3) Seat Cushion: The cushion assembly shall have a minimum of 16 coil springs for each passenger area, and each coil spring shall be made of No. 10-1/2 or 11 gauge, steel spring wire and be painted. Cushion coil springs shall be equal in quality and performance to Royersford four-way lace web with "O" type center ring. Each coil spring shall be secured to the plywood bottom by means of at least three wire staples. The tops of the coils shall be clipped together, and bound and spring wire laced in order that they will act together. Full border wire shall be No. 8 gauge steel wire. The bottom of the seat cushion shall be five ply, at least 1/2 inch thick exterior grade fir plywood. The plywood bottom of the seat cushion shall be completely painted. The cushion shall be fastened to the frame by means of two hardened steel hinge straps a minimum of 1/8 inch thick which extend approximately 1/2 way around the front frame tube and a single spring clip at the back which catches under the frame tube. Hinges and clip shall be attached to cushion bottom by rivets, or bolts with "T" nuts. The hinges and clip shall be so installed as to prevent the cushion from forward or side creeping. Cushion depth shall be as per Chicago Transit Authority's Drawing No. SD-1036, latest revision.

(4) Topping: The topping for all seat cushions and padding for backs shall be fire retardant, flexible, polyether urethane foam, to be approved by the Engineer. Topping shall be at least 1-1/4 inch thick. A latex impregnated sisal pad of approximately 1/2 inch thick shall be installed between the topping and the spring assembly in such a manner as to prevent shifting.

(5) Covering: Seats shall be covered with material which shall comply with Chicago Transit Authority Specification No. SSM-1448, latest revision, grain and color to be selected by the Engineer. The cushion and back covering joinings shall be made

Sec. 3 - Car Body (Cont'd.)

3.09 - Seats (Cont'd.)

(b) (5) (Cont'd.)

with "welt" seams using No. 100, or heavier nylon thread. The cushion top surface and front foldover, and seat back coverings, shall only be seamed at the ends. The turnback of the cushion and back covering shall be at least 1-1/2 inches beyond the edge of the wood frame.

(6) Stanchions: Approximately every other cross seat on each side of the car shall be equipped with a stanchion which shall extend from the rail at the top of the back to the car ceiling. The stanchion fittings shall be at the aisle side and shall be as per Chicago Transit Authority's Drawing No. SD-1036, latest revision. The method of locking the stanchion to the seat and the fitting to be used must be approved by the Engineer.

(7) Finish: All painted portions of the framework shall be approved baked enamel; color as shown in Container Corporation of America, Color Harmony Manual, 3rd Edition, color to be selected by the Engineer. Finish of stainless steel and grinding of welds and lugs shall require approval.

(c) Single Passenger Seats: Three single passenger seats are required for each car. These three seats shall be of the same construction as the two-passenger seats but with finish and dimensions as follows:

(1) Single passenger seat oppostie the cab on each car as shown on Chicago Transit Authority Drawing RS-5058. Tube across the top of the back to be 18-8 stainless steel; seat legs and foot plates to be 18-8 stainless steel, plate on back of seat back to be 0.025 inch thick mild steel, painted, using color shown in Container Corporation of America, Color Harmony Manual, 3rd Edition, color to be selected by the Engineer.

(2) There shall be two, single passenger seats at the conductor's position on "A" car, having dimensions as shown on Chicago Transit Authority Drawing RS-5073. The entire seat frame, including foot plates, shall be made of 18-8 stainless steel. The back of the seats shall have an approved embossed 18-8 stainless steel plate, 0.018 inch thick.

(3) There shall be two, single passenger seats against the sides of No. 2 end of "B" car having dimensions as shown on Chicago Transit Authority Drawing RS-5073, and with 18-8 stainless steel tube

Sec. 3 - Car Body (Cont'd.)

3.09 - Seats (Cont'd.)

(c) (3) (Cont'd.)

across top of seat back. Seat legs and foot plates shall be 18-8 stainless steel. The plate on back of the seat back shall be made of 0.025 inch thick mild steel and shall be painted, with colors as shown in Container Corporation of America, Color Harmony Manual, 3rd Edition, color to be selected by the Engineer.

(d) Motorman's Seat: The motorman's cab shall be equipped with a two-passenger seat of the same type and construction as those in the rest of the car, except the seat cushion shall be hinged so that it shall lay up against the seat back. An approved latch shall be provided to hold the seat cushion against the back when desired. The complete seat shall be arranged so that it can be raised and moved forward to act as a seat for the motorman. A seat of the type desired is shown on Heywood-Wakefield Company's Drawing C-101910, or General Seating Company's Drawing No. 3557. The motorman's seat cushion and back shall be covered with the same material as the other seats in the car. The seat shall be painted using colors as shown in Container Corporation of America, Color Harmony Manual, 3rd Edition, color to be selected by the Engineer.

(e) Samples of a two-passenger cross seat with stanchion fitting on frame, one of each type of single passenger seats, and motorman's seat shall be shipped prepaid to the attention of the Division Engineer, Chicago Transit Authority, 3701 Oakton Street, Skokie, Illinois, for the approval of the Engineer, before production manufacture of any style seat. The sample seats, when approved, shall become the property of Chicago Transit Authority and the costs for the sample seats shall be included in the bid price.

3.10 - Doors

(a) All doors throughout the car shall be double sheathed and be made of metal, or plymetal. The finish covering shall be compatible with the exterior and interior finish of the car, subject to the approval of the Engineer. Doors shall be equal in quality and performance to those shown on Morton Manufacturing Company's Drawings 5710-6, 5711-6 and 6029-6, all of latest revision, or O.M. Edwards, Drawing D-14252. Doors shall be free of dimples, warping or spot welding depressions. End and cab doors may be Morton bond construction. All hinges shall be mounted on jig drilled holes. As far as practical, the door Manufacturer shall mount the door hardware before shipping the doors. All surfaces, inside and outside, of any doors made of mild steel shall be

Sec. 3 - Car Body (Cont'd.)

3.10 - Doors (Cont'd.)

(a) (Cont'd.)

given a heavy coat of primer, by the door Manufacturer. The interior surfaces of any aluminum doors shall be primed by the door Manufacturer, with zinc chromate, or other approved primers.

(b) Side Doors: The side entrance doors shall be curved to the same contour as the side of the car and be arranged to swing as indicated on the drawings. Each opening shall be closed by means of two doors, each consisting of two leaves, glazed with 7/32 inch thick laminated safety sheet glass equal in quality and performance to L.O.F. EZ-EYE, set in rubber glazing channels without sash. The doors shall be the "blinker type" and have upper door leaf brackets, and guides on lower side of the door operator box, to accomplish the same type of travel as those on the Presidents' Conference Committee streetcar. The doors shall be weatherstripped effectively on sides, bottom and top to prevent the entrance of air and elements. The door rods shall have curved lower arms arranged so that the weatherstrip on the bottom of the doors will not rub on the lower arm. If side sliding doors are proposed, the arrangement of operating and suspension systems, and the design and layout of door pockets shall require the approval of the Engineer. The interior of the door pockets shall be made of 18-8 stainless steel.

(c) End Doors: The end doors of the cars, shall be hinged as shown on Chicago Transit Authority Drawing RS-5119. The end doors shall have two sash, the lower fixed and the upper arranged to drop outside of the lower sash. The drop sash shall be equipped with two locks having 18-8 stainless steel latches with the locks on inside of car. Sash shall be 6063 T4, anodized aluminum, or equal, with a satin finish. All glass in end door sash shall be 7/32 inch laminated safety sheet glass equal in quality and performance to L.O.F. EZ-EYE, set in rubber glazing channels. The No. 1 end door sash shall be equal in quality and performance to sash shown on Adams and Westlake Drawing WM-3537. The No. 2 end door sash shall be equal in quality and performance to sash as shown on Adams and Westlake, Drawing DM-5381. The doors shall be effectively weather-stripped at top, bottom and sides and shall be water tight. The end doors on No. 1 and No. 2 end of the car shall be fitted with locks equal in quality and performance to Adams and Westlake Company, No. 1769, Drawing DM-5129, latest revision. Both end doors shall be equipped with a suitable rubber edge, covered with an approved material, to act as a hand protector extending 24 inches above the lock. Doors shall have three hinges, as shown on Adams and Westlake Drawing No. BM-2965, Rev. C or equal.

Sec. 3 - Car Body (Cont'd.)

3.10 - Doors (Cont'd.)

(d) Cab Doors: Motorman's cab doors shall be arranged to swing as shown on Chicago Transit Authority Drawing RS-5119. These doors shall be glazed with 7/32 inch L.O.F. green safety sheet glass, or equal, set in rubber glazing channels without sash. The cab door shall have a hinged arm to hold the door open approximately 8 inches when needed for ventilation. The arm shall be Adams and Westlake No. 1044 or equal. These doors shall clear the floor approximately 1/4 inch and have a piece of weatherstrip to close this opening. Doors shall be sealed or weatherstripped to prevent rattle. The opening between the cab door and the post to which it is attached shall be closed by a suitable roll type door opening seal equal in quality and performance to Morton Manufacturing Company Drawing No. 7009-3. Internal stiffeners shall be provided for the attachment of hardware and train 'phone bracket. Train 'phone bracket stiffener shall be for a bracket approximately 1 in. by 13 in. which shall be located on inside of the door, 41 in. above bottom of the door, and 8 inches from the left side of the door.

3.11 - Stanchions, Barriers, Grab Handles - Interior

(a) All stanchions, barriers and grab handles shall be provided as shown on the Chicago Transit Authority Drawing RS-5119. All stanchions shall consist of 1-1/4 inch O.D. 18-8 stainless steel clad tubing with an approved finish. The stainless steel shall have a thickness of not less than 0.026 inch. The insert shall be made of mild steel and shall have a wall thickness of 0.049 inch. Stanchion fittings and screws shall be 18-8 stainless steel.

(b) Vertical stanchions shall be provided for the nine (9) two-passenger seats indicated on Chicago Transit Authority Drawing RS-5119. The stanchions shall extend from the socket in the seat frame to the ceiling.

(c) Side Door Barriers: A shaped metal barrier made of No. 18 gauge rigidized 18-8 stainless steel shall be installed adjacent to the seats at both sides of each side entrance door, as indicated on the Chicago Transit Authority Drawing RS-5119. The edge toward the outside of the car shall be attached to the side door post, and the inside edge shall be attached to a metal stanchion which extends from floor to ceiling. These barriers shall have a protecting and stiffening molding along the exposed top edge. There shall be a horizontal rail above the barrier with a space of approximately 3 inches between the top of the barrier and bottom

Sec. 3 - Car Body (Cont'd.)

3.11 - Stanchions, Barriers, Grab Handles - Interior

(c) (Cont'd.)

of the rail. If there is a door operator box installed in the header above the door opening, there shall be a fully reinforced toe hole provided in the right hand barrier at each side door to be used as a step to permit a man to reach the apparatus.

(d) Side Door Stanchion: A vertical stanchion shall be installed at the center of each side door opening, between the floor and ceiling, as shown on Chicago Transit Authority Drawing, RS-5119, and having a horizontal rail extending to the post between the doors. A guard plate made of rigidized 18-8 stainless steel shall be provided to prevent passengers from catching their hands between the open door and the horizontal rail, if blinker type doors are used. This plate shall be reinforced along the upper edge to resist bending and be attached to the post and horizontal rail as shown on Chicago Transit Authority Drawing SK. E-111157.

(e) Conductor's Area Stanchions: A vertical stanchion from floor to ceiling shall be provided on each side of the "A" car at the conductor's area. Each stanchion shall have a horizontal rail attached to the side post of the car to define the conductor's area as shown on Chicago Transit Authority Drawing No. RS-5119.

(f) A vertical grab handle of 18-8 stainless steel shall be installed on the corner of each cab partition, secured by 18-8 stainless steel bolts. A smaller 18-8 stainless steel horizontal grab handle shall be installed on the inside of each end door below the glass; grab handle shall be attached with 18-8 stainless steel barrel bolts.

(g) All stanchions and rails shall be 18-8 stainless steel clad and all fittings, including screws, shall be 18-8 stainless steel, or approved equal. Stanchions, including vertical seat stanchions, shall be fitted with an approved rubber type cup, at both ends of the stanchion.

Sec. 4 - Drawbar and Coupler Equipment

4.01 - Coupling Drawbar

(a) The coupler equipment on the No. 1 ends of the two-car units shall be an approved automatic "hinged head" type providing mechanical and electrical coupling. The drawbar equipment shall be arranged for manual operation at track level from the left corner of the car. The upper and lower uncoupling shaft on the drawbar head shall have square ends for positive locking to the uncoupling levers. Lock bar shall be indexed in an approved manner so as to clearly show the locked position. The uncoupling chain shall be of the twisted link type to prevent catching in guides and pulleys, and shall be supported in an approved manner without springs. The coupler must permit free negotiation of all curves, both lateral and vertical as specified in Section 2.02 when units are coupled with maximum mismatch due to spring deflections and wheel wear. The swing of the drawbar shall be limited to maximum required by suitable stops. A latch of approved design shall be included to hold unused couplers in the center position. This latch shall be automatically withdrawn by the throwing of the jumper switch to the coupled position.

(b) The draft gear shall be rubber-cushioned, and of an approved type. It shall be capable, within reasonable margins of safety, of withstanding loads resulting from the type of service described in this Specification. The draft gear deflection shall not exceed one inch under 90,000 lb. load. The draft gear shall have emergency release studs, which will shear at 90,000 pounds and the drawbar shall have additional shear studs that shall shear at 110,000 pounds. With both sets of shear studs broken, the coupler head shall have approximately 20 inches of free travel to permit the car body to deform and absorb the force. The design of the shear studs shall be such as to require no special tools and only a minimum of labor to restore the drawbar to normal operation.

(c) All parts of the drawbar equipment shall be of annealed cast steel and shall be designed to withstand the above specified loads and stresses. Provision shall be made for the drawbar anchor pin to be removed through a covered hole in the floor, and the drawbar anchor pin shall have a sufficient number of nylon spacers above and below drawbar tailpiece to make the tailpiece tight in the clevis type anchor casting and to reduce noise. Couplers shall be equal in quality and performance to Ohio Brass Company's Form 5D tightlock couplers as shown on Ohio Brass Drawing E-4649, and shall couple with Form 5A, 5B and 5C couplers. All important bearing surfaces in the drawbar and coupler shall be bushed with readily replaceable hardened steel bushings, and provision shall be made for adequate lubrication. The knuckle pin and its bushings shall be made of 11-14 percent manganese steel.

Sec. 4 - Drawbar and Coupler Equipment (Cont'd.)

4.02 - Non-Coupling Drawbar

(a) The two cars forming a semi-permanent coupled unit shall be joined with a tubular steel drawbar having two draft gears and approved connections to the car center sills, but without coupler heads. Adequate clearance shall be provided between drawbar anchors and axle gear boxes. The drawbar draft gears shall be rubber cushioned and have emergency release studs that shear at 90,000 pounds to provide a total of approximately 31 inches of free travel. Drawbar anchors and draft gear shall be equal in quality and performance to that shown on Ohio Brass Company's Drawing No. E-4652, Type EER.

(b) An approved type safety hanger shall be installed on each car under the semi-permanent drawbar to prevent a broken or detached drawbar from dropping to the road bed.

4.03 - Electric Couplers

(a) The electric coupler shall be installed under each car coupler, and have sixty-eight (68) contacts to complete the trainline circuits. All trainline wires shall be fitted with snap connectors for attaching the trainline wires. The inner ends of all contacts shall be insulated so as to prevent accidental shorts. All contacts shall have silver faces, with two flats instead of screw driver slots. The electric coupler shall have an approved type of automatic cover to protect the electrical contacts on each electric coupler from rain, snow, ice and dirt. The rubber insulation block gasket shall have drain slots in the bottom edge.

(b) A drum type jumper switch shall be installed on the coupling end of each car to disconnect circuits going to the electric coupler. The jumper switch shall be manually operated from each side of the car, and each operating handle shall be pulled or pushed in the direction of the motorman's cab to open the jumper switch. The operating handles shall be moved away from the motorman's cab to close the jumper switch. Means shall be provided to obtain a positive positioning of the jumper switch. These rods shall have indexing marks to indicate the position of the jumper switch.

(c) Each jumper switch shall have the required number of contacts of sufficient capacity to handle the circuits required in this specification.

(d) The electrical connections between the two-semi-permanently coupled cars of a unit shall be carried in multiple conductor neoprene sheathed jumper cables, supported by cable blocks attached to the drawbar. Drawbar cables shall be arranged so as to be free of stress in all operating positions, and to prevent chafing. Cable

Sec. 4 - Drawbar and Coupler Equipment (Cont'd.)

4.03 - Electric Couplers (Cont'd.)

(d) (Cont'd.)

terminal board connections in junction boxes shall be accessible for quick disconnecting, and shall require approval of the Engineer.

(e) The electric coupler and cover shall permit emergency mechanical coupling with present Chicago Transit Authority, 6000 class cars.

Sec. 5 - Miscellaneous Car Body Items

5.01 - Advertising Card Racks

The advertising card racks shall be integral with the general fluorescent car lighting system, running the full length of the car, insofar as possible, on both sides, except at the cab. The top and bottom moldings shall accommodate eleven (11) inch translucent advertising media. The general scheme shall be similar to that as shown on Luminator, Inc. Drawing No. 18548, titled, Direct, Indirect Lighting System, With Provisions For Back Lighting The Car Card Area, except for 11 inch cards instead of 9 inch. Installation and design shall be approved by the Engineer.

An approved metal frame shall be furnished, of the proper size to hold a 21 in. by 22 in. advertising card. The frame shall be mounted on the back of the motorman's cab and securely fastened to prevent vibration, and projection shall be held to a minimum. The 22 inch dimension shall be vertical. Location of advertising card frame shall be as directed by the Engineer.

5.02 - Coil Springs and Safety Chains

There shall be three coiled wire safety springs attached to the right hand corner post on the cab end of the car, and three coiled wire safety springs attached to the left hand corner post of the No. 2 end of the car. The safety springs shall be of such length that they may be hooked to the adjacent corner post on a car coupled to that end. The opposite corner post on each end of the car shall have suitable brackets to which these springs may be hooked. On the motorman's cab end, means shall be provided to prevent these springs from swinging when not attached to an adjacent car. These springs and brackets shall be Chicago Transit Authority standard. These springs shall be made of 2014T6 aluminum. The spring hooks shall be made of wear resistant aluminum which will not squeak when rubbing on brackets and shall be replaceable with hand tools. Both spring hooks shall be formed from 3/8 inch 2017T4 aluminum. See CTA Drawing RS-5115.

There shall be three 1/4 inch link safety chains on each end of the car attached to the right hand end door post, on the cab end of the car, and attached to the left hand end door post on the No. 2 end of the car, and of such length that, in one position, they may be attached to the opposite end door post on the same car, or in another position, be attached to the adjacent end door post of a car coupled on that end. Chains shall be welded aluminum, anodized and unpainted.

5.03 - Destination and Run Number Signs

(a) A front end, remote controlled destination sign box shall be installed above the end door on the No. 1 end of the car as shown on Chicago Transit Authority Drawing RS-5119. The sign shall be of the roller curtain type. The front sign rollers and roller components shall be in accordance with Chicago Transit Authority's standard sign roller Drawing No. RS-5070. The rollers shall accommodate 24 inch wide curtains. No curtains shall be furnished. The sign boxes shall be illuminated by means of two fluorescent 20 watt lamps. The opening through the front of the box shall be approximately 9 inches by 23

Sec. 5 - Miscellaneous Car Body Items (Cont'd.)

5.03 - Destination and Run Number Signs (Cont'd.)

(a) (Cont'd.)

inches. The sign box shall have a spring loaded, hinged cover in the back of the box. The box shall be designed to permit cleaning of the front window glass and curtain. Any deviations from any parts of this destination sign shall require approval of the Engineer.

(b) Two remote controlled side destination sign boxes shall be installed, one on each side of the car above the side window sash, location to be approved by the Engineer.

The sign shall be of the roller curtain type. The side sign rollers and roller components shall be in accordance with Chicago Transit Authority's standard sign roller Drawing No. RS-5070. The rollers shall accommodate 22-1/4 inch wide curtains. No curtains shall be furnished. The opening through the front of the box shall be approximately 7 inches by 21 inches. There shall be a piece of clear laminated safety sheet glass on the back of the box, of the proper size so that the interior illumination of the car shall illuminate the sign curtain so the curtain can be read from both the outside and the inside of the car. The box shall be hinged at the top to permit cleaning of the window glass and be equipped with approved fasteners. Both the top and bottom inside edges of the box shall have large radii. Any deviations from any part of this destination sign shall require the approval of the Engineer.

(c) Control of Front and Side Destination Signs: Both the front and side destination signs shall be controlled through train wires and a switch in the motorman's cab by means of which the motorman can set up any destination in all signs on a train from the cab at the front of the train. A rotary switch shall be supplied in each cab, plainly marked with the destination, to accomplish this control. The B+ feed to the control switch shall be opened when the master controller is locked up. The signs shall provide a minimum of five destinations. The signs and their control shall be approved by the Engineer.

(d) A three numeral illuminated run number sign shall be installed in the end sheet, above the cab window. The sign box shall be installed so that curtain rollers may be read and turned from inside the cab with separate controls for each curtain. Sign opening in end of the car shall be covered with 7/32 in. laminated safety sheet glass set in glazing rubber. Illumination shall be provided by three #68L, 12-16 volt, automotive type lamps wired in series with a suitable resistor and fed from the 40 volt dc headlight switch. Sign box curtains shall have numerals, X's, black, and red spaces on each end of the curtain as shown on Chicago Transit Authority Drawing SK. E-30962. Numerals and lettering shall be 4 inches high, style Sans-serif, Gothic Futura, Semi-Bold.

(e) Run number signs shall be approved by the Engineer before manufacture.

Sec. 5 - Miscellaneous Car Body Items (Cont'd.)

5.04 - Car Numbers

The car numbers shall be installed above the side window sash, on each side of the car, as shown on Chicago Transit Authority Drawing RS-5119. The numbers shall be clearly back illuminated by interior car lighting or other approved means. The numerals shall be the Company's standard as shown on Chicago Transit Authority Drawing RS-5095, applied by stencils to sand blasted glass with black, baked enamel background. Glass shall be secured in car body by use of glazing rubber. The use of laminated glass, or other approved laminated materials, with white numerals on black background between the lamins, will be acceptable. Material and installation of car numbers shall require approval of the Engineer.

5.05 - Fire Extinguisher

The Car Builder shall furnish a dry powder fire extinguisher equal in quality and performance to Ansul Model 5, equipped with special non-kink 20 inch hose assembly as shown on Ansul Chemical Company Drawing No. 8699. The dry chemical powder shall be Purple K. The extinguisher shall be mounted horizontally in an approved box having a 3/32 in. glass set in an approved rubber glazing channel at the conductor's end of the "A" car, located as directed by the Engineer.

5.06 - Cab Accessories

(a) The motorman's cab window shall be equipped with a 40 volt dc electric windshield wiper with control located in the cab. Wiper shall be equal in quality and performance to American Bosch heavy-duty 40 volt dc electric windshield wiper (Drawing No. CX72-2704, Ft. No. 2) with pantograph arm approximately 18 inches long. Arm shall have adjustable spring to control blade tension on windshield and shall be fitted with a clutch, or other provisions which will prevent shaft breakage when wiper arm is manually moved. Wiper shall be capable of making 75 complete cycles per minute on wet glass without speed control provisions. When control switch is turned off, the wiper arm shall automatically park the blade at the right hand end of the stroke.

(b) The front window in the motorman's cab shall be equipped with a double faced curtain having suitable metal rollers and pinch handle fixtures. There shall be suitable curtain guides, which are closed at both top and bottom, to limit the travel of the curtain fixtures. This curtain shall be equal in quality and performance to Adams & Westlake Company No. 108. Curtain shall be as shown on Adams & Westlake Drawing CM-2856. A suitable sun visor may be substituted for the front cab window curtain, subject to the approval of the Engineer.

Sec. 5 - Miscellaneous Car Body Items (Cont'd.)

5.06 - Cab Accessories (Cont'd.)

(c) The Car Builder shall furnish and install in each cab of every fifth unit a rugged electric speedometer. The equipment shall consist of a magnetic pick-up unit having a toothed wheel mounted on the motor shaft. The ac signal from the sending unit shall be rectified and fed into a dc indicating voltmeter calibrated to read in miles per hour. Meter shall have a dial approximately 3-1/2 inches across, having 100 deg. scale and reading from 0 to 75 miles per hour. Dial shall be illuminated by means of a pilot lamp, which may take the place of the resistor in the run number sign light circuit. Speedometer equipment shall be equal in quality and performance to Westinghouse Electric Corporation proposal, dated November 27, 1962, NCGI-1089. The remaining cars shall have wiring installed from the sender location to the speedometer meter location in the cab, with end of the wires marked and taped for later use, in the event speedometers should be desirable for remaining cars. All traction motors on this order of cars shall have provision for attaching a speedometer sending unit to make the motors interchangeable. The sender unit may be mounted on the gear boxes instead of the motor, subject to the approval of the Engineer. If the sender is mounted on the gear box, then all gear boxes shall be adapted for the sender installation, and traction motors would not require provisions for sender.

(d) A power control relay by-pass switch shall be provided to permit moving the train in event of side door interlock circuit failure by electrically by-passing the power control relay contacts. This switch shall be so designed and mounted that it will display a yellow flag visible through the front cab window when in the by-pass position. Chicago Transit Authority Drawing SK. E-41162 suggests a possible design of a switch to accomplish this purpose. Final design and location shall be approved by the Engineer.

(e) A push button shall be located in a box having a replaceable glass window, by which the motorman can by-pass a defective emergency relay circuit to move a train. Engineer shall approve location.

(f) A push button shall be furnished in the cab for operating the electric sanders, location to be approved by the Engineer. The feed to this push button shall be through a master controller contact closed in all operating positions.

(g) A push button shall be furnished in the cab for operating the track brakes. Location to be approved by the Engineer. The feed to this push button shall be through the same master controller contact that feeds the sander push button.

(h) The equipment mentioned in Sections 5.06 (d), (e), (f) and (g) shall be marked with name plates as described in Section 9.04 (d).

Sec. 5 - Miscellaneous Car Body Items (Cont'd.)

5.06 - Cab Accessories (Cont'd.)

(i) The motorman's cab shall have a coat hook, a hook and bracket for holding the brake actuator operating handle, a bracket for holding a long handle sleet scraper, and a bracket and plug with cable for a train 'phone as described in Section 5.08 (i). Each cab shall have a 1-1/2 gallon Miller-Peerless RE Steel, Dome Top, Pump Tank fire extinguisher or equal. Design, location and mounting of these devices shall be approved by the Engineer.

5.07 - Horn

The Car Builder shall furnish and install under the floor of the car, an electric horn, equal in quality and performance to Federal Sign & Signal Corporation Model No. 56 Resonating Horn, deriving its power from the 40 volt dc circuit and operated by a pull switch and cord in the motorman's cab.

5.08 - Miscellaneous Inside Items

(a) A 2 in. by 8 in. by 6 ft. long wooden gang plank shall be provided in each car. Plank shall be painted to match the car interior, and mounted as directed by the Engineer.

(b) A buzzer signal system shall be installed on each car with a buzzer and push button located in each conductor's side door control box and in each motorman's cab. The signal system shall be connected through all cars in a train. At all door operating positions which are not manned, the push buttons shall be inoperative. The buzzer equipment is included as part of the side entrance door operating equipment.

(c) A conductor's emergency switch as described in Section 10.03 (f) (4), shall be located in each car with a concealed operating cord equal to Danco, 6D, clear vinyl, wire center, Apex 585, extending the length of the car with an exposed end at the No. 2 end of the car, and with a handle on the cord in the motorman's cab. Location to be approved by the Engineer.

(d) The Car Builder shall furnish all the necessary hardware to make the car complete in every respect, which shall include door locks, keepers, hinges, catches, holders and springs.

(e) Both end doors shall be equipped with a door closer having a "hold open" arm and key valve control equal in quality and performance to LCN #D-H90. Adequate stiffeners shall be provided for mounting the door closer. In addition, a positive door stop having a rubber bumper shall be provided to limit the amount of each end door's opening. Design and location of the positive door stop shall require approval of the Engineer.

Sec. 5 - Miscellaneous Car Body Items (Cont'd.)

5.08 - Miscellaneous Inside Items (Cont'd.)

(f) The motorman's cab door shall be equipped with an approved lock which shall have a spring loaded latch operated by Chicago Transit Authority's standard conductor's key, equal to Adams & Westlake Company Part No. 304202. The latch shall positively lock the door in both operating positions. The lock shall be on the inside of the door, have a tee handle on inside and key escutcheon plate only on the outside. There shall be a flush door pull on the outside of the door. Key escutcheon plate and flush door pull shall be fastened with rivets or other approved means. A hold open device, Adams & Westlake #1044, or equal, shall be provided to hold the cab door approximately 8 inches open for ventilation. A piece of 18-8 stainless steel shall be placed on the outside of the cab door to prevent damage by the end door latch when both doors are opened at the same time.

(g) The hinges, locks, catches and holders for all the doors shall be equal in quality and performance to those furnished by Adams & Westlake Company and shall require the approval of the Engineer. Insofar as it is possible, the door Manufacturer shall apply the hardware to the doors. All hardware, grab handles, and unpainted metal surfaces on all doors shall have a satin finish.

(h) Each "A" car shall be equipped with two electric sanding devices, equal to Consolidated, Type S-425-A2, operating off of the 40 volt dc battery circuits. Two approved type sand boxes shall be installed on the wall side of the single passenger seats at the conductor's area. Boxes shall be designed so as to provide for easy filling and shall have a removable galvanized wire screen with 3/16 inch mesh in frame fastened in box with sheet metal screws and have a rugged hinged cover fitted with an approved spring lock operated by Chicago Transit Authority's standard conductor's key. Electric sanders shall be mounted below the sand boxes, and equipped with flexible hoses which connect to metal pipes on the trucks extending down to approximately three inches from the rail, to which replaceable extensions of rubber or plastic shall be secured. The pipes shall be attached to the truck frame for support. A suitable push button shall be installed on the window sill in front of the master controller in the motorman's cab for operation of the sanding devices.

(i) The Car Builder shall furnish and install the fixed components to accommodate Model No. TP-2601, Femco train 'phones. The fixed components comprise the connection plug and cable, the mounting bracket, 2.0 mfd. 2500 WVDC capacitor, 600 volt dc 5 amp fuse, 40 volt dc 5 amp fuse and connecting wiring as shown on SK. E-121362. The connection to the 600 volt dc trolley shall be made to the 600 volt dc bus on the auxiliary switch panel described in Sec. 9.04 (a). The train 'phone system shall be wired to the car public address system so train 'phone announcements can be made throughout the train, when desired.

Sec. 5 - Miscellaneous Car Body Items (Cont'd.)

5.09 - Miscellaneous Outside Items

The Car Builder shall furnish and install all the necessary grab handles, hand holds, clamps and steps, to make the car complete and serviceable in every respect. The following grab handles shall be provided on the outside of the car:

(a) Two steel horizontal grab handles fitted with anti-slip plates on the end sill on the motorman's cab end, one on each side of the anti-climber.

(b) A vertical steel grab handle recessed at each corner post on the motorman's cab end.

(c) A steel horizontal grab handle under the end windows on the motorman's cab end.

(d) A vertical steel grab handle on the front of corner post opposite cab.

(e) A steel vertical grab handle on each of the end door posts.

(f) A steel vertical grab handle recessed in the center post at each side door entrance.

(g) A steel vertical grab handle recessed in the side sheet at each side door opening.

(h) A steel climbing step shall be located below each side door and at both corners of the car at the motorman's cab end. The steps shall be bolted to suitable brackets which in turn are riveted to the car underframe. Step area shall be upset or dimpled with a punch for anti-slip purposes.

(i) The area outside the end doors, shall be fitted with an approved type anti-slip floor plate. This plate shall be kept 1-1/4 inches back of the outside edge of the anti-climber, and bolted in place.

(j) Car Builder shall furnish and install on the motorman's cab corner post a receptacle per Chicago Transit Authority Sketch, SK. E-111962, for mounting a car borne coil for automatic inter-locking operation.

(k) A locker with hinged door shall be provided under each car to hold trolley rope and third rail shoe slippers. Four wood slippers and a bracket per Chicago Transit Authority Drawing PCC-12, and four 6 foot lengths of No. 9 trolley rope having a loop tied in one end shall be provided. Locker shall be accessible from side of the car. The door shall be stenciled with a yellow "T" 2 inches high.

Sec. 6 - Side Door Control and Signal System

6.01 - General

(a) Blinker Door Operator

The door control circuits shall provide for multiple unit door control. Each side entrance door having four (4) leaves shall be operated by means of one electric motor, equal in quality and performance to Consolidated Corporation's DE-151-C2, or Vapor Corporation Model 63-E electric door operator, mounted above the doors in a suitable box. The bottom of the box shall be rigid enough to prevent its flexing when the side doors are operated, without depending on the door operator equipment base plate for additional support. The box shall have hinged doors with louvers to permit air from the car to enter the box. The hinged doors shall have approved devices to hold the doors open, and approved Alnico, or equal, permanent magnet catches to hold the doors closed.

(b) Side Sliding Door Operator

If sliding side doors are used, the door operator and controls shall be equal in quality and performance to the equipment called for in 6.01 (a). The controls shall perform the same functions as called for under Blinker Doors. The entire installation shall be in general conformity to that described in Transit Research Corporation Specifications for Rapid Transit Cars, latest revisions, where pertinent to Chicago Transit Authority operations. The complete design and installation shall be approved by the Engineer.

6.02 - Control Switches

The door control switches shall be in the conductor's area of the "A" car with the door control boxes located as selected by the Engineer. Each door control box shall contain two toggle type switches, a signal buzzer, a signal push button and a positive feed switch operated by Chicago Transit Authority's standard conductor's key. One toggle switch shall operate all the doors on that side of the train to the right of this position and the other all the doors on that side of the train to the left. The control of the doors shall be so connected that all the doors on one side of the train may be controlled from any one door operating position on that side of the train. Zone switches operated by Chicago Transit Authority's standard conductor's key shall be located in the switch cabinet in the motorman's cab so that any desired group of doors on adjacent cars may be operated from any door operating position on that side of the train within the group. Conductor's door control switch shall be approved by the Engineer, and be so constructed as to prevent accidental electrical shock.

Sec. 6 - Side Door Control and Signal System (Cont'd.)

6.03 - Outside Entrance Switch

A switch, operated by Chicago Transit Authority's standard conductor's key, shall be located on the inside of the side body panel immediately to the rear of No. 4 side door by means of which the side doors at this location may be operated independent of the other door control switches. This switch shall be so constructed that the key can be removed only in the "door closed" position, have the key slot extend through the side sheets to the outside and have the opening protected by a spring loaded weatherproof hinged cover, Crouse-Hinds DS-10G condulet cover, or equal. An approved access panel to maintain this switch shall be provided in the interior finish.

6.04 - Signal Lights

A green signal light in the motorman's cab as described in Section 9.04 (b) (4) shall be so wired that only the one in the cab at the front of the train will be illuminated when all side doors in the train are closed. The feed for the green light shall be fed through an interlock on the power control relay. A red signal light mounted on the outside of the car above each side door opening shall be so wired that it will be illuminated when the adjacent doors are open. Provision shall be made so that these lights will be automatically cut out when all master controllers are locked up. The outside signal lights shall be equal in quality and performance to Adams & Westlake No. 1399, and shall have red lenses.

6.05 - Control Interlocking and Passengers' Emergency Switch

The door control circuits shall be interlocked with the propulsion motor control circuits so that power to the motors will be interrupted while any side door on any car in the train is open.

In event that a motorman moves back in the train to another cab, due to master controller failure, the power interlock feature shall be operative from that cab without the necessity of throwing any jumper switch. A suggested circuit to accomplish this is shown on Chicago Transit Authority SK. E-41062. Any deviation from this circuitry shall be approved by the Engineer.

A door cutout switch to by-pass the door operator interlock in case of a failure of a side door operating mechanism shall be located in each door operator box.

A passenger's emergency switch shall be installed in the bottom of each blinker door engine box, so located that the operating handle will pull down through the bottom of the box. This handle when pulled down shall open the door electrically, and shall unlock the

Sec. 6 - Side Door Control and Signal System (Cont'd.)

6.05 - Control Interlocking and Passengers' Emergency Switch (Cont'd.)

door mechanically in the event of battery power failure and shall not require excessive pull to operate. Means shall be provided so that the side doors which have been opened by the passengers' emergency switch may be closed at these doors without opening the door operating equipment box and may also be closed from the conductor's operating position.

A passengers' emergency switch for sliding side doors shall perform the same functions as specified for blinker doors. The design and location of the passengers' emergency switch for sliding side doors shall be approved by the Engineer.

A power control relay by-pass switch shall be provided to permit moving the train in event of side door interlock circuit failure, by electrically by-passing the power control relay contacts. This switch shall be so designed and mounted that it will display a yellow flag visible through the front cab window when in the by-pass position. Chicago Transit Authority SK. E-41162 suggests a possible design of switch to accomplish this purpose. Final design and location shall be approved by the Engineer.

6.06 - Sensitive Edges

The edge of each blinker door leaf which contacts an adjacent leaf in the closed position shall be equipped with an approved type sensitive edge so arranged that the door operator will reverse to open the doors in case anything is caught between the closing door leaves. This feature shall be cut out when the door leaves are within less than 1-1/2 inches of each other. Means shall be provided to maintain the accurate adjustment needed in the sensitive edge circuits. The rubber used to enclose the sensitive edge shall be held onto the door with aluminum strips having jig drilled holes for interchangeability. Stainless steel screws shall be used for attaching aluminum strips. The inside strips shall be in two pieces, length to be approved. Sensitive edge cables shall be made of 18-8 stainless steel and other parts of the mechanism shall be made of corrosion-resistant metals subject to the approval of the Engineer. The sensitive edge feature shall extend down to within 1-1/2 inches of the floor in order to be operated by a passenger's foot which might be caught in a closing door.

Sliding side doors, if used, shall be equipped with sensitive edges on the meeting edges of the doors and shall function as described for blinker doors. Design and installation shall be approved by the Engineer.

Sec. 6 - Side Door Control and Signal System (Cont'd.)

6.07 - Power and Wiring

The control and motor equipment for side doors shall derive power from the 40 volt dc line. Wiring shall provide cushioned operation in both opening and closing of doors. Door control wiring diagrams shall be approved by the Engineer.

6.08 - Mounting and Cam Switches

The blinker door operating equipment which is located in the box above the doors shall be, as far as practical, rigidly mounted on a base plate. This base plate shall only serve to maintain alignment of the door operating equipment. Any cam switches used shall be constructed so as to permit individual adjustment of the cams. Each cam shall have three holes for set screws. The cam locking means shall be easily accessible from the front of the door operator box.

The sliding side door operating equipment, if used, shall be located by the Car Builder in the most accessible manner for easy maintenance, subject to the approval of the Engineer.

Sec. 7 - Heating and Ventilating

7.01 - Resistor and Motor Cooling

(a) Each traction motor armature shaft shall be equipped with a fan so as to be self cooling.

(b) The main motor resistors shall be mounted under the car in the open so as to provide natural cooling.

7.02 - Car Heating and Ventilating

(a) General

The Car Builder shall install a combined forced air heating and ventilating system. A motor driven blower (or blowers) shall be located in a compartment (or compartments) under the car. Air from the blower (or blowers) shall be carried to the car body through ducts and discharged into the car body along the sides through grilles in a truss plank type skirt guard and upwards along the car sides to defrost the windows in the winter. Finned strip electric heaters shall be located in the truss plank skirt guard in the air stream to provide heat in winter. The same fan (or fans) shall provide forced air ventilation in the summer through the same ducts and openings in the truss plank skirt guard. The air intake for the ventilating fan (or fans) shall be on the sides of the car near the roof for the outside air and on the inside of the car near the floor for recirculated air. Manually operated dampers shall be provided for restricting the outside air intake in the winter to 20 percent of the total air circulated and completely closing off the interior air intake in the summer to provide 100 percent outside air intake.

(b) Fan

The fan (or fans) in the heating and ventilating system shall be operated from the 40 volt dc battery power and arranged to run when any master controller in the train is in an operating position. They shall provide a total of 3000 cfm of outside air in the summertime, and a mixture of 600 cfm of outside air and 2400 cfm of recirculated air in the wintertime.

(c) Ducts

All underfloor ducts and fan housings shall be suitably insulated to prevent chilling the recirculated air during winter operation. Removable clean out plates shall be provided to make cleaning of the ducts as easy as possible. The underfloor ducts shall connect to the skirt guard so that the air will be directed as described in the following paragraph. Filters shall be provided in the ducts between the fans and the car body in such a manner as to be easily removed for cleaning.

Sec. 7 - Heating and Ventilating (Cont'd.)

7.02 - Car Heating and Ventilating (Cont'd.)

(d) Heaters and Skirt Guard

The electric heaters shall be the truss plank type located in an 18-8 stainless steel skirt guard running the full length of each side of the car except at the side door openings. Skirt guard shall have a sloping top to prevent accumulation of dirt. The skirt guard shall have easily removable grille plates at each heater to permit easy cleaning and replacing of defective heater elements. The skirt guard shall have slots in the top so arranged that a portion of the warm air will be directed upward behind the wainscot panel and discharged through slots along the bottom of the window sash. The remainder of the warm air shall be discharged horizontally across the car floor through the grilles in the side of the skirt guard.

Each truss plank heater shall contain two finned strip heater elements of different wattage, located one above the other with the low wattage one on top. Twelve of these heaters shall be located on each side of the car; one heater on the cab side of the car shall be in the motorman's cab. Wiring to all heater elements shall have fiber glass or asbestos insulation and shall be attached with Eaton Tenz-nuts. The heaters shall be equal in quality and performance to those furnished by Railway Utility Company and Vapor Corporation.

(e) Auxiliary Ventilating Fans

Four overhead ventilating fans, each capable of furnishing approximately 2000 cfm of air, shall be located in the headlining in housings fitted with manually operated dampers so that the fan can intake, exhaust or recirculate the air. A reversing switch shall be provided at each fan so that it can be operated in either direction. Electric finned strip heaters shall be provided in the housing to warm the air when desired. When dampers are completely closed off, they shall be weather tight to prevent entry of rain. Any housing on the outside of the car shall project a minimum distance above the roof.

(f) Main Heat Control

All of the low wattage heater elements on each side of the car shall be connected in series and the two groups connected in parallel to form the No. 1 heat circuit of the car. Similarly, the high wattage elements shall be connected in series on each side of the car and the two groups in parallel to form the No. 2 heat circuit. Each circuit shall be connected to the 600 volt trolley circuit through its heat contactor and 600 volt fuse located in the auxiliary switchboard cabinet under the car. Contactors shall have 40 volt dc operating coils with switches in cab switch cabinet to cut out the heat on the individual car, when desired.

Sec. 7 - Heating and Ventilating (Cont'd.)

7.02 - Car Heating and Ventilating (Cont'd.)

(f) Main Heat Control (Cont'd.)

The No. 1 heater contactor shall be controlled through a train wire from a pair of "P" type spring return switches located in the switchboard cabinet in the motorman's cab. One switch turns on all of the No. 1 heaters in the train; the other turns them off. Similarly, the No. 2 heater contactor is controlled through another train wire and a pair of "P" type spring return switches that control all of the No. 2 heaters in a train. By turning on either one or both circuits of heat, three different steps of heat can be obtained. A thermostat shall be located on an insulated mounting at a height and location near the center of the car body as directed by the Engineer. The thermostat shall be the mercury type and have any needed resistor and relay to drop out both heat contactors when the car body is above 65 deg. F. Another mercury thermostat shall be located as directed by the Engineer to bring in the No. 1 heat contactor on its car whenever the temperature drops below 32 deg. F in the car, even though no heat has been turned on by the "P" switches and train wires.

(g) Auxiliary Fan And Heat Control

The four auxiliary fans shall operate in series from the 600 volt dc trolley circuit, through a contactor and 600 volt fuse on the auxiliary switchboard under the car. The 40 volt dc operating coil of the contactor shall be fed from the battery contactor so that the fans will operate when any master controller in the train is turned on. A small knife switch shall be provided in the fan contactor coil circuit so that fans can be made inoperative if desired. The speed of the fans shall be regulated by means of a mercury thermostat so as to run at reduced speed as the temperature drops. The speed control shall provide at least three operating speeds.

The heaters in the overhead fan housings shall be fed from the 600 volt dc trolley circuit through a contactor and 600 volt fuse on the auxiliary switchboard under the car. The operating coil of the contactor shall be fed from the 40 volt dc battery circuit of the car and a mercury type thermostat arranged to turn on the heat whenever the car temperature drops below 60 degrees F and the fans are operating. A thermal cut-out shall be provided in each fan housing to turn off the heaters in event of overheating.

(h) Performance

It shall be the responsibility of the Car Builder to install the necessary wattage of electric heat to maintain, at a height of 3 feet from the floor, a temperature of at least 45 deg. F above outside ambient temperature with a cross wind of 30 mph. This

Sec. 7 - Heating and Ventilating (Cont'd.)

7.02 - Car Heating and Ventilating (Cont'd.)

(h) Performance (Cont'd.)

temperature shall be maintained with the dampers set for recirculating 80 percent of the air and intaking 20 percent of fresh air. There shall be no objectionable hot spots or drafts throughout the car.

(i) Cab Heat

A cab heater containing two 500 watt 300 volt finned enclosed heater elements shall be mounted on the front sheet in the motorman's cab, remotely controlled by means of a switch on the motorman's switch panel, a contact in the master controller and a contactor on the auxiliary switch panel. The feed for the heater shall be from the 600 volt dc supply through a contactor and a 600 volt fuse. The heater shall be shut off whenever the master controller is "locked up." Heater shall be provided with a duct and 40 volt dc fan to direct sufficient heat to the front cab window to provide defrosting. Heaters shall be equal in quality and performance to those previously furnished by Railway Utility Company and Vapor Corporation. Wiring to elements inside the heater case shall have asbestos or fiber glass insulation and shall be attached to the elements with Eaton Tenz-nuts or equal.

(j) Alternating Current Fan Motors

Consideration shall be given to the use of alternating current heating and ventilating fan motors.

(k) The Car Builder shall build a mock-up of the heating and ventilating system to determine any required changes before proceeding with the construction. The entire design of the heating and ventilating system shall be approved by the Engineer.

Sec. 8 - Lighting

8.01 - Interior Lighting

(a) Car Body Lights

Fluorescent: The Car Builder shall furnish and install an approved interior fluorescent lighting system. This system shall include fixtures, tubes, controls and accessories to make the system complete. The system shall provide 25 to 30 foot candles of lighting at the seated passenger's reading plane, that plane being 33 inches above the floor and on a 45 deg. angle. The reading plane for the standee passengers shall be provided with 25 to 30 foot candles of lighting. The fluorescent lights shall operate on ac power supplied by a static inverter operating off the 600 volt dc supply, or by a motor-alternator and controls. The power system or lighting system shall not cause any interference with the operation of the P.A. system or the train 'phone which operate between 80 and 100 kc. A decal reading "Danger, High Voltage" shall be placed on the inside of the front end destination sign box door and at any other location where fluorescent light circuits are exposed. Car Builder shall submit for approval of the Engineer a complete layout of the proposed system showing type of lamps and fixtures, including locations.

The fixtures shall be direct, indirect, with provision for back lighted car cards for advertising purposes. This car lighting, and advertising card lighting system shall be equal to that as shown on Luminator, Inc. Drawing 18548, except that card openings shall accommodate an 11 inch card. The fixtures shall have clear prismatic lenses made of acrylic plastic.

The car body lights shall be controlled by means of a relay operating from a train line wire energized from a 40 volt dc switch, in the motorman's cab so that all the lights in a train can be turned on or off by the motorman.

(b) Cab Light

A fluorescent light shall be provided in the motorman's cab mounted in an approved fixture. This light shall be wired to light whenever the main car body lights are turned on and the cab door is positioned so passengers may use the cab seat. This fluorescent fixture shall also have a 60 watt incandescent lamp fed from the 40 volt dc battery circuit through a "P" type switch on the motorman's switch panel and also arranged to light when the emergency interior lights are on and the cab door is positioned so passengers may use the cab seat.

Sec. 8 - Lighting (Cont'd.)

8.02 - Destination and Marker Lights

(a) The illumination of the front destination sign shall be accomplished by the use of fluorescent lighting of approximately 40 watts, controlled by a switch in the motorman's cab. The lighting shall be approved by the Engineer.

(b) Marker Lights: The Car Builder shall furnish two approved 4 lens marker lights on the No. 1 end of the car as shown on Chicago Transit Authority Drawing RS-5119. Each lens shall be of spread type, colored glass, arranged in order, from the side of car inward, as follows: Red, yellow, green and white. The marker lights shall use 20 watt, 40 volt dc, S8 DC Bayonet Base lamps, No. CM8-95, and shall be arranged for relamping from inside the car. Power for these lights shall be taken from the 40 volt dc battery circuit on the car through a circuit breaker "P" type switch in the motorman's cab. Each 4 light unit shall be wired to a 5 position rotary type switch in the motorman's cab so that any one of the four colored lights can be selected, as well as "Off". Each switch position shall be marked to show the color of the light it controls.

8.03 - Tail Lights and Emergency Lights

(a) Two approved heavy duty tail light fixtures, the appearance and shape to conform to the lines of the car, shall be installed below the windows on the No. 1 ends of the car as shown on Chicago Transit Authority, Drawing RS-5119. The lens shall be made of red glass, spread type. The lamps shall be 25 watt, 40 volt dc, A-19 clear, medium screw base, and shall be arranged for relamping from outside of the car. Power for these two lights shall be taken from the 40 volt dc battery circuits on the car, through a circuit breaker "P" type switch in the motorman's cab, marked "Tail Lights". Design and installation shall be approved by the Engineer.

(b) There shall be four emergency incandescent, 25 watt, medium screw base lamps, deriving their power from the 40 volt dc line. The fixtures for the lights shall be installed in the fluorescent light fixture, if possible. If not possible, the fixtures and mounting shall be approved by the Engineer. The emergency lights shall be located over each side door opening. These four 40 volt dc emergency lights shall be controlled by a relay on the switchboard under the car, so as to light only when the main fluorescent lighting system is turned on and its source of power is interrupted.

Sec. 8 - Lighting (Cont'd.)

8.04 - Headlights

Headlight: One built in electric headlight fixture shall be installed on the cab end of the car as shown on Chicago Transit Authority Drawing RS-5119. The headlight shall have a 60 watt, 38 volt PAR 46 lamp and be of such design that the headlight fixture may be moved for adjustment. A quick connect plug shall be installed inside the headlight housing to facilitate bulb replacement. This plug shall be Jones Connector, parts #S-302CCT and P-302CCT with the male portion connected to the bulb. A switch for controlling the headlight lamp shall be located in the motorman's cab. The headlight shall be Pyle-National Company's C-2785, or equal.

8.05 - Lamps

The Car Builder shall furnish and install all lamps required on the car. Main car fluorescent lamps shall be F72T12/CW/IS, and F48T12/CW/IS. Fluorescent lamps in the motorman's cab, and destination sign shall operate from the same power supply as furnished for the main car lights and size shall be compatible with the sign box opening, and cab ceiling size. Effort shall be exercised to furnish the same size lamps for both the destination sign and cab light fixture. The incandescent lamps shall be as specified for their respective use and fixture.

Sec. 9 - Miscellaneous Electrical Equipment

9.01 - Wiring of Car

(a) All wiring shall conform to the latest revision of the "N.F.P.A. Regulations for Electric Cars and Trolley Buses." All wire used shall be of approved type and quality. No thermoplastic insulated wire shall be used.

(b) The layout of wiring shall be designed in advance of its installation and in co-operation with those Manufacturers furnishing the related equipment. Insofar as practical, all wiring shall be fabricated on the bench into convenient units and installed in prefabricated groupings and standardized locations. Grounding connections shall be copper, brazed and bolted, or welded and bolted to the car frame.

(c) Wires having different types of current and different potentials shall not be carried in the same conduits or ducts or be cabled together. All wiring on the car, including the battery circuits, shall be insulated for 600 volts.

(d) All wires and terminal studs shall be plainly and permanently marked with tags approved by the Engineer. All wires shall be marked with tags, or otherwise identified, at all pull boxes, unless color coded. All wire terminals shall require the approval of the Engineer. Where any wiring enters a conduit or duct, or passes through any partition, rubber bushings or other approved type of protection, such as fiber or metal bell-mouths, shall be provided to prevent abrasion of the insulation. Where wires pass through partitions or any metal plate, protection shall be provided on both sides. The open end of all conduits coming through the floor shall extend 1 inch above the floor.

(e) All wiring which is subjected to heat from such things as car heating elements, resistors, or heat sinks, shall have asbestos or glass insulation. All exposed bus bars, except ground, shall be insulated or covered to prevent accidental contact. Any covers over fuses or exposed conductors shall be asbestos lined.

(f) All underfloor wires and cables shall be carried in ducts, rigidly supported conduit, or open raceways where conditions permit and cables and wire are neoprene sheathed. The transmission of high voltage ac between the "A" and "B" cars shall be as recommended by the Manufacturer of the motor-alternator set, or the Manufacturer of the static inverter. All underfloor wiring and cable layouts shall be approved by the Engineer. All brake circuit junction boxes under the car shall be equal in quality and performance to Crouse-Hinds No. SKM842 with polyethylene interior coating. Wiring in loom may be used above the floor as approved by the Engineer.

Sec. 9 - Miscellaneous Electrical Equipment (Cont'd.)

9.02 - Auxiliary Power Supply

(a) General: A motor-alternator, or a static inverter and a static converter shall be furnished on the "A" car to provide alternating current for a fluorescent lighting system and through silicon rectifiers shall furnish approximately 40 volts dc to charge the battery and operate the controls, lights and other auxiliary circuits on the cars. The motor-alternator or static inverter and static converter shall be capable of safe and ample performance at any supply voltage between 450 and 650 volts dc.

The alternator of the motor-alternator set shall have sufficient capacity to carry the fluorescent light loads on the "A" and "B" cars, and to charge the storage battery hereinafter specified and to maintain substantially constant voltage on the various auxiliary car circuits connected to the battery.

The static inverter shall have sufficient capacity to carry the fluorescent light load of both cars. The static converter shall maintain substantially constant voltage on the various auxiliary car circuits and charge the battery hereinafter specified.

The motor-alternator, or static inverter and static converter shall either be self-regulating with respect to all functions, or be equipped with regulating devices as necessary to enable it to perform all its functions properly and safely. The regulated voltage for battery charging shall be adjustable between 35 and 42 volts dc and shall hold its adjustment with trolley voltage variations between 450 and 650 volts dc.

(b) Motor-Alternator

(1) The motor and alternator shall be an integral unit, dynamically balanced and shall be supported on rubber bushings. The motor-alternator shall be arranged for ready removal and replacement, ordinary inspection, servicing and adjustment including replacement of brushes. The leads connecting motor and alternator with car body leads shall have bolted connectors.

(2) The lubricating holes of the motor-alternator set bearings shall be fitted with standard 1/8 inch pipe plugs to prevent unauthorized lubrication.

Sec. 9 - Miscellaneous Electrical Equipment (Cont'd.)

9.02 - Auxiliary Power Supply (Cont'd.)

(b) Motor-Alternator (Cont'd.)

(3) The motor of the motor-alternator set shall have sufficient capacity to drive the alternator when delivering all power required for controls and auxiliary equipment, and for charging the storage battery.

(c) A 600 volt dc, rugged push button or spring return safety switch shall be provided in the auxiliary switchboard cabinet under the car to start the MA set or static converter when the battery is dead. Push button or spring return switch shall be connected across the 600 volt dc contacts of the battery contactor.

9.03 - Storage Battery

(a) The "B" cars shall be provided with an Electric Storage Battery Company's nickel-iron-alkaline battery, or equal, consisting of 24 cells. The battery shall have sufficient capacity to meet the load requirements and duty cycle, of both "A" and "B" cars, for the type of service required. The battery shall be mounted in a rolling tray which will permit drawing the battery out of the box for inspection and maintenance, unless other approved provisions are made to inspect and maintain the batteries. Box interior and tray shall be given a heavy coat of an approved corrosion resistant material, and box shall have provisions for adequate ventilation and drainage.

(b) All batteries in a train will be connected in parallel by means of the B+ and B- wires in the train line cables. B- terminal of the battery cable shall be grounded at a ground connector on the car frame at the battery.

(c) Battery shall be shipped to the Car Builder discharged and short circuited. Batteries shall be charged by Car Builder in accordance with battery Manufacturer's recommendations. Battery maintenance tools shall be shipped direct to Chicago Transit Authority's Division Engineer, 3701 Oakton Street, Skokie, Illinois, F.O.B. destination.

9.04 - Switch Panels

(a) Auxiliary Switchboard: A switchboard, housed in a suitable metal box under the car, shall be provided on which shall be mounted the necessary switches, contactors, fuses and resistors to control the operation of the various auxiliary circuits on the car and train. This box shall be lined with an approved insulating coating on bottom,

Sec. 9 - Miscellaneous Electrical Equipment (Cont'd.)

9.04 - Switch Panels (Cont'd.)

(a) (Cont'd.)

two ends, the top and cover. The front of the box shall provide a full opening. For the 40 volt dc circuits, all switches unless otherwise specified shall be the circuit breaker "P" type, or equal, which will not require a fuse. Contactors of suitable size and design to close and open the circuits shall be furnished for the 600 volt dc circuits, each of which circuits shall have cartridge type fuses. These contactors shall each have a battery voltage operating coil for remote control. The layout of the box, switchboard and apparatus thereon, shall be as required by the type of controls furnished on the cars. All devices, fuses and switches shall be identified with name plates or other approved means. This equipment shall be equal in quality and performance to that as furnished by Vapor Corporation, subject to the approval of the Engineer. In general the auxiliary switchboard shall contain such items as the following:

(1) "P" type switches shall be furnished for the following circuits; propulsion control, door control, heat and ventilation control.

(2) "A-B" type, de-ion switches with back contacts, for main feeds to the battery.

(3) An enclosed 600 volt dc auxiliary circuit switch having a blow out.

(4) Contactors to control the heat, car lights, and overhead fans.

(5) Relays to control emergency lights, heat and thermostat.

(6) Fuses for heat, M-A set, car lights, and train phone circuits.

(7) M-A starting safety switch.

(8) Knife switches as required.

(9) Train phone capacitor.

(b) Motorman's Switch Panel: A switch panel shall be located to the left of the motorman's position in the cab. The following circuit breaker type "P" switches, signal lights, fuses, push button, and horn pull switch shall be mounted on this panel:

Sec. 9 - Miscellaneous Electrical Equipment (Cont'd.)

9.04 - Switch Panels (Cont'd.)

(b) (Cont'd.)

(1) "P" type switches shall be furnished for the following 40 volt circuits; control positive, line breaker reset (spring returned), car lighting, headlight, windshield wiper, tail lights, cab heater, cab heater defroster, and 40 volt dc cab light.

(2) "P" type switch for fluorescent, front destination sign lights.

(3) 40 volt rotary switches for control of marker lights, and remote controlled, front and side destination signs.

(4) Two Kirkland 659 D/E signal lights, or equal, with 64 volt S-6 candelabra base lamps, one with green lens, and one with amber lens.

(5) Fuses for horn and sander.

(6) Buzzer push button, Electric Service Company #23357, or equal.

(7) Horn pull switch, Electric Service Company #66231, or equal, with cord and guides.

(c) Switchboard: A switchboard shall be located in the motorman's cab on which is mounted the following apparatus:

(1) "P" type switches shall be furnished for the following circuits; motor control, and heater controls.

(2) Motor control cut out switch and door control zone switch.

(3) Relays for power interlock and door signal light.

(4) Two Hubbel #5887 polarized receptacles, wired with approximately 50 ft. of No. 12 A.W.G. rubber covered stranded copper wire in each lead, connected to shunts in the motor propulsion circuits. The receptacle for the No. 1 and No. 2 motors shall be mounted above the receptacle for the No. 3 and No. 4 motors. Both receptacles shall be marked to show motor numbers to which they are connected.

(5) A signal buzzer shall be mounted outside the switchboard cabinet in an approved location.

(6) A matching transformer, and a 4 mfd., 1000 volt blocking condenser for the public address system.

(7) Switches shall be provided to cut out heating circuits on individual cars in event of a defective heater.

Sec. 9 - Miscellaneous Electrical Equipment (Cont'd.)

9.04 - Switch Panels (Cont'd.)

(d) General: All switches and fuses shall be identified by clearly marked anodized aluminum plates, with raised letters on black background.

9.05 - Third Rail Contact Shoe Devices

(a) Each truck shall be provided with brackets on each side for mounting the Company's standard third rail shoe beams. The design of the brackets shall provide for height adjustment of the beam to compensate for wheel wear. The Car Builder shall furnish and install on each side of the truck under the motorman's cab end (No. 1 end) of the car, Chicago Transit Authority's standard current collector beam and sleet scraper assembly, with flashboard as shown on Chicago Transit Authority Drawing RS-5120, latest revision. The Car Builder shall furnish and install on each side of the truck under the No. 2 end of the car, Chicago Transit Authority's standard current collector beam assembly, without sleet scraper, with flashboard as shown on Chicago Transit Authority Drawing RS-5120.

(b) The flashboards for both No. 1 end and No. 2 end current collectors shall be made of 3/8 in. exterior grade plywood and painted with an approved electrical insulating paint.

(c) Each trolley beam shall be fitted with a fuse, made of solid bare copper wire of proper size to provide protection to the electrical equipment.

(d) The trolley lead shall be attached to the beam securely as shown on the beam assembly drawing.

9.06 - Truck Wiring

(a) Flexible ground leads shall be provided from the car body to each truck transom, and from each transom to the ground brush on its adjacent axle.

(b) Truck wiring, including trolley, ground and motor leads shall be carried on the frame supporting the motor insofar as possible, in order to reduce to a minimum any movement of cable between truck parts. The cable shall be securely fastened and suitably protected against chafing. Protective sleeves for cables shall be made of neoprene or natural live rubber. Clamps for attaching cables to truck frame shall have approved insulated sleeves. Where knife joint connectors are used, these connections shall be protected with sleeves and mounted on treated wood blocks, or approved fiber, with the ends of the rubber sleeves taped to the cables.

Sec. 9 - Miscellaneous Electrical Equipment (Cont'd.)

9.06 - Truck Wiring (Cont'd.)

(c) Ground connections on trucks and car body shall be made of copper, bolted and brazed to the steel members.

(d) The ground cable connectors, between trucks and car body, shall be made of extra flexible neoprene covered cable with approved terminals. The cable shall have brackets to secure the cable insulation near the terminal connections to prevent flexing and stressing the cable strands as they enter the terminals. Terminals shall be of swedge type, forming a square or hexagon shaped collar.

(e) The knife joint connectors in cables from trucks to car body shall be enclosed in a wood box similar to SK. E-92561. The cable insulation shall fit tight against the connectors (no conductors exposed) and the conductors shall be protected by rubber hose between the cable clamping members. Creepage distance to ground shall be as great as possible.

(f) The shoe tie cables between the current collector beams shall be connected by means of approved "T" type connectors to the cables running up to the car body knife joint connectors. The "T" type connectors shall be thoroughly insulated and waterproofed.

9.07 - Public Address System

The Car Builder shall furnish and install an approved public address system by means of which the conductor can make announcements throughout all cars of a train. The equipment to accomplish this shall be as follows:

Each car shall have three (3) speakers, one located at the center of the car and one near each end. Speakers shall be University Model MM-2F, or equal. Speaker openings shall be covered with perforated metal grilles. These speakers shall be connected to the proper train line wires through a suitable matching transformer and a 4 mfd., 1000 V. blocking condenser. A plug equal to Amphenol No. 75-MC1F and jack equal to Amphenol No. 75-MC1M shall be furnished to permit disconnecting the car speakers from the train wire.

In addition to the above, each "A" car shall have a high impedance dynamic microphone and an approved "press-to-talk" push button at each of the two conductor's operating positions. The "press-to-talk" push button shall be mounted on an 18-8 stainless steel plate, satin finish. The microphone shall be Turner Model BD, or equal, and mounted in a box per Chicago Transit Authority Drawing RS-5107. Each "A" car shall also have a 30 watt 70 volt constant potential output transistor amplifier operating on the 40 volt dc battery power of the car and feeding into the speaker train wire (No. 62) and the B- train wire. Amplifier shall be Femco Model AM-2573, or

Sec. 9 - Miscellaneous Electrical Equipment (Cont'd.)

9.07 - Public Address System (Cont'd.)

equal. Battery power to the amplifier shall be supplied from either of the conductor's key operated door control switches. The amplifier shall contain a relay, operated by the "press-to-talk" push button that will energize the amplifier and connect the output to the train wire circuits. Response of the amplifier to the "press-to-talk" push button shall be instantaneous. To insure interchangeability with present equipment, the amplifier shall have the dimensions and fittings shown on Chicago Transit Authority Drawing RS-5092.

Sec. 10 - Motors, Brakes, Controls and Accessories

10.01 - General

(a) Each car shall be fitted with four (4) high-performance traction motors, equal in quality and performance to Westinghouse Electric Corporation's No. 1454 or General Electric Company's No. 1250 motors, and a complete control equipment for their operation. The control shall incorporate series-parallel connections, field shunting and dynamic braking.

(b) Motors, brakes, controls and all related equipment and apparatus shall be designed and built to provide an adequate margin of capacity and safety for the operation intended. It shall be designed also, to prevent excessive maintenance or service interruption under the weight and other specifications given herein, and with schedules demanding operating characteristics equivalent to those listed in Section 10.02 (a).

(c) The brake system shall consist of extended dynamic motor brakes, motor mounted friction brakes with slack adjusters and track brakes.

Consideration shall be given to an approved supplemental electrically operated tread or axle brake when its reliability has been proven in both tests and revenue service.

The type of motors and control shall require approval of the Engineer.

(d) The motor and brake control shall be designed for multiple unit operation, using multiples of two car units, in trains of from two to ten cars.

10.02 - Capacity and Characteristics of Traction Motors

(a) The following operating factors shall be used for calculating the performance of the equipment to be furnished hereinunder:

Total weight light car	45,000 lb.
Total weight, car and seated passenger load	52,500 lb.
Total weight, car and max. passenger load	67,500 lb.
Average voltage	550 dc
Average length of run	2/3 mile
Average length of stop	15 sec.
Wheel diameter, new	28 inches

Sec. 10 - Motors, Brakes, Controls and Accessories (Cont'd.)

10.02 - Capacity and Characteristics of Traction Motors (Cont'd.)

(a) (Cont'd.)

Gear ratio	approx. 6 to 1
Min. number of cars in train	2
Max. number of cars in train	10
Grade resistance	0

The Davis formulae shall be used in calculating the train resistance under the above conditions.

(b) The motors shall have capacity to operate continuously with a tractive effort of 700 pounds and maintain a speed of 45 mph with a trolley potential of 275 volts. The motors shall be capable of accelerating a light two-car train on level tangent track to a speed of at least 30 mph in 14 seconds, and to a speed of at least 60 mph in 110 seconds. These speeds shall be attained with a 550 volt dc trolley voltage and with an average current demand, per car, not exceeding 540 amperes for a period of 15 seconds. The cars shall have a balance speed under the same conditions of, at least, 65 mph. A speed limit relay or other approved device shall be provided so that the top speed can be limited to some lower value if desired for operation over certain routes.

The Car Builder shall submit with his bid, a speed-time and a power-time (per car) curve for a 2/3 mile start to stop run for a two-car train of light cars under the conditions stated in Section 10.02 (a).

(c) The dynamic brake shall be capable of decelerating a light car at 3.2 mphps rate.

(d) It is intended that the latest development made by the electrical equipment companies shall be provided under this Specification. Motors shall be self-ventilated and windings designed to be impervious to air-borne water and snow.

(e) Motors shall be of the high-performance type and insulated with Class F insulation or better. They shall be free of objectionable windage and commutator noises. Motor leads and case shall be marked.

(f) Armatures shall be dynamically balanced within a maximum unbalance of 1.0 in. oz. Balancing shall be with ferrous metal correction weights, applied by welding, or other approved methods.

(g) The maximum safe motor speed shall be not less than 6000 rpm.

Sec. 10 - Motors, Brakes, Controls and Accessories (Cont'd.)

10.02 - Capacity and Characteristics of Traction Motors (Cont'd.)

(h) Electrical connections shall be by motor leads fitted with jack knife connectors. Connectors shall be marked to correspond with marking on motor leads and motor case.

(i) All motors on this order of cars shall have provisions for attaching a speedometer sending unit to make the motors interchangeable, if a motor mounted sending unit is provided for the speedometer.

10.03 - Acceleration and Braking Controls

(a) Master Controller: A master controller shall be provided in the motorman's cab which will control both acceleration and braking from a single handle. This handle shall be of the "dead man" type which will shut off power and apply full dynamic brakes when released in an operating position. After a "dead man" operation, the controller shall require turning to the B-3 brake position before the handle can be depressed. The master controller shall provide the following performance with light car on the positions as listed:

Power Positions	Acceleration Rate mphps	Speed Range mph
1	Very Low	Switching
2	1.5	15-20
3	3.2	40-45
4	3.2	65 minimum, balance

Coast Position   Free wheeling, or with a minimum coasting current

Brake Positions	Deceleration Rate mphps
1	1.5 dynamic
2	2.2 dynamic
3	3.2 dynamic
4 (Emergency)	3.2 dynamic, with track brakes, and with a friction brake rate set up to the limits of wheel adhesion.

The reverser mechanism shall be operated by Chicago Transit Authority's standard reverse key, equal to Westinghouse Air Brake Company's No. A529107, and shall have Chicago Transit Authority standard positions.

The master controller shall be as waterproof as reasonably possible. The head of the master controller shall be marked with positions as listed in this section. Circuits which are made up all the time

Sec. 10 - Motors, Brakes, Controls and Accessories (Cont'd.)

10.03 - Acceleration and Braking Controls (Cont'd.)

(a) (Cont'd.)

that the controller is in an operating position shall be operated by cams on the reverser shaft instead of the main handle. Chicago Transit Authority Drawing SK. E-11563 indicates the cam arrangement desired, subject to adaptation for the control circuits used. The entire master controller, including the fingers, shall be approved by the Engineer.

(b) Contactors, Switches and Resistances: The acceleration and braking resistors, together with their contactors, switches or accelerator, shall incorporate the latest improvements as developed by the electric companies for this type of control. Static components and static limit relays shall be used wherever field tests have indicated their satisfactory use. The acceleration and braking resistors shall be mounted in the open for natural ventilation and shall be protected from wheel wash. Any other equipment subject to water damage shall also be protected from wheel wash. The main motor knife switch shall be of the single pole double throw type having extra contacts to accomplish the following functions. In the operating position, the 600 volt dc trolley shall be connected to the main motor circuits and to the auxiliary circuits through separate stationary contacts. In the non-operating position, the switch shall connect the auxiliary circuits to a test receptacle into which a 600 volt dc jumper plug may be inserted to permit operation of the auxiliaries in the shop. The main motor switch shall be mounted in such a manner that it can be reached from either a pit or from alongside the car without the need of removing a compartment cover.

(c) Boxes: All boxes used to enclose the motor control equipment shall be lined with an approved type insulation and weather sealed. If the car floor is used as the top of any control box or compartment, the floor shall be covered with 1/4 inch transite. Any part of the car frame which might contact the arc from some contactor shall be covered with 1/4 inch transite with secondary insulation. All junction boxes shall have brass or stainless steel bolts, and brass or stainless steel hasps. All junction box covers shall be lined with an approved insulating material.

(d) Indicators and Alarms: There shall be a buzzer located in the motorman's cab so connected that it shall operate whenever any line switch overload trip in the train has operated and the master controller is in any operating position. This buzzer shall be tuned to have a different sound from the other buzzer in the cab. In addition, one signal light shall be located as directed on each side

Sec. 10 - Motors, Brakes, Controls and Accessories (Cont'd.)

10.03 - Acceleration and Braking Controls (Cont'd.)

(d) (Cont'd.)

of each car and arranged to light by a circuit established through an interlock on the line switch, or other approved means, whenever the overload feature of the line switch operates, and shall remain lighted until manually reset, even though the master controller is locked up. Lights shall be equal to Adams & Westlake #1399 indicating lights with blue lens having 10 watt, 40 volt bulb.

(e) Emergency By-Pass Features: The car control shall incorporate the following by-pass features to permit moving a defective train with the minimum delay.

The contacts of the power interlock relay shall be connected to a by-pass switch located in the front cab window so that its yellow flag handle can be seen from the outside of the car when it is used to cut out the control power interlock feature of the door control. Chicago Transit Authority SK. E-41162 suggests a type of switch for this use. A push button shall be located as directed by the Engineer in a box having a breakable glass window by which the motorman can by-pass a defective emergency relay circuit to move a train.

Provision shall be made by means of which the door control power interlock and the emergency relay operation will be retained on all cars in a train in event the motorman moves from the front cab to any other in the train. This shall be accomplished without the need to throw any jumper switches. Suggested circuits to accomplish this are shown on Chicago Transit Authority SK. E-41062.

Means to accomplish these ends shall be approved by the Engineer.

(f) Brakes:

(1) The main brake shall be of the dynamic type, wherein the traction motors will function as generators and the braking resistors will provide the load on the generators. The dynamic brake shall be the extended type which will function down to a car speed of approximately one mile per hour. When the dynamic brake fades out, a friction brake shall automatically apply, blending with the dynamic brake to make a smooth stop. In event of dynamic brake failure, the friction brake shall automatically apply at the same rate as called for by the master controller and make the stop in the same distance. Approved track brakes shall also be provided for emergency use. When the control cutout switch is fully thrown, the motor control of the car shall be cut out and the friction brakes electrically released. When the control cutout is thrown to the mid position, the motor control of the car shall be cut out and the friction brakes will remain spring applied.

Sec. 10 - Motors, Brakes, Controls and Accessories (Cont'd.)

10.03 - Acceleration and Braking Controls (Cont'd.)

(f) (Cont'd.)

(2) Four rates of braking shall be provided by the master controller as specified in Section 10.03 (a). The friction brake shall provide the same three rates as the dynamic to enable a smooth transition from one type of brake to the other. The fourth or emergency brake rate shall be obtained by superimposing the friction brake on the No. 3 dynamic rate. Also, all track brakes in the train shall be applied in addition to the dynamic and friction brakes. A brake application caused by the release of the "dead man" handle of the master controller shall apply only the No. 3 dyanmic brake rate until the dynamic brake fades out, after which the No. 3 friction brake shall finish the stop. The necessary train wire, contactors and fuses shall be provided to accomplish this. A push button, located in the motorman's cab to the left of the master controller shall be provided to apply the track brakes throughout a train independent of the master controller position.

(3) An amber signal light shall be located in the motorman's cab as detailed in Section 9.04 (b) (4), and wired to light when any friction brake in the train is applied. There shall also be two amber signal lights on the outside of each car near the roof on the No. 2 end which will also light when the friction brakes are applied. These outside lights shall be Adams & Westlake Company's #1399, or equal having amber lenses and 10 watt 40 volt bulbs. Whenever a friction brake is manually released, the outside brake lights shall remain lighted but the cab brake light will be extinguished. All amber friction brake lights shall be extinguished when all master controllers in a train are "locked up."

(4) A track trip switch shall be provided at the left front corner of the No. 1 truck of each car as detailed in Section 11. A conductor's emergency switch shall be located in each car as detailed in Section 5.08 (c). Operation of any of these switches on any car in the train shall open the emergency relay circuit which will cut off traction power and apply the brakes in full dynamic plus friction. The conductor's emergency switch shall be Westinghouse Air Brake Company's Pc. #548635 with spring return, or equal and the track trip switch shall be Westinghouse Air Brake Company's Type A-3-A, or equal, but with the operating lever increased 1-1/2 inches in length.

Sec. 11 - Trucks

11.01 - General

(a) Each car equipment shall consist of two, four wheel swiveling trucks, each having two traction motors, one driving each axle. Truck shall be CTA-1 design as shown on Chicago Transit Authority's SK. E-40661, latest revision, and shall comply with the detailed requirements as listed in this Specification. The Truck Builder shall be responsible for all detail design and drawings for making this truck.

(b) The trucks shall be completely assembled by the Truck Builder or the Car Builder ready for operation, including the mounting of motors, wheels and brake equipment as specified. The truck shall be lubricated as per schedule provided by the Engineer.

11.02 - Weights and Dimensions

(a) Trucks shall be designed to carry a 25,000 pound center plate load. All truck members shall have the necessary strength with ample safety factor to resist all stresses which may develop in service when operated with the above center plate load, at speeds up to 65 mph.

(b) The completely assembled trucks with motors, brakes and other equipment must not exceed the clearance limits required between the truck and car body, or between the truck and roadway for safe operation with maximum load and wheel wear, over minimum lateral and vertical curves, as well as tangent track. The minimum clearance above the top of running rail (except directly over the rail) shall be 2 inches with worn wheels, after allowance for full spring deflection.

(c) The wheel gauge shall be A.A.R. standard for 4 feet 8-1/2 inches gauge track.

(d) The weight of two trucks, complete with motors, braking and current collecting equipment ready to run shall be approximately 22,000 pounds. The wheel base of the trucks shall not exceed 6 feet, 6 inches.

11.03 - Design Features

(a) Frame: The truck frame shall consist of two independent side frames each having a rigidly attached transom member. The transom members, at their free ends, shall be flexibly connected to the opposite side frame when truck is assembled. The side frame shall have accurately machined housings to clamp around the journal bearings through rubber to provide needed flexibility. Truck Builder shall consult

Sec. 11 - Trucks (Cont'd.)

11.03 - Design Features (Cont'd.)

(a) (Cont'd.)

with the bearing Manufacturer in the design of this clamp and rubber assembly to insure proper bearing loading. Side frames and transoms shall be steel castings.

(b) Bolster: The bolster shall be of cast steel construction with provision for the P.C.C. type center plate and king pin as shown on Chicago Transit Authority SK. E-40661. Center plate shall have a removable member as shown on Chicago Transit Authority Drawing SK. E-70962, to facilitate shimming as wheels wear. A measuring hole shall be provided through the bolster and spring rockers for checking spring assembly.

(c) Wheels: Wheels shall be 28 inches diameter, rolled steel, with rim toughened treads of A.A.R. standard cylindrical contour. After being bored, wheel hubs shall be magnafluxed for internal flaws. The wheels shall be mounted on the axles at a pressure between 50 and 70 tons. A hydraulograph record shall be made of each wheel pressed on and, to be acceptable, the graph obtained shall correspond with those shown as "acceptable", "good" or "ideal" in the Association of American Railroads' Wheel and Axle Manual, Section XV, "Wheel Press Practice." The records of the wheels mounted each day shall be submitted to Transit Authority's inspector for his approval before trucks are assembled. The hydraulograph records become the property of the Transit Authority. Wheels shall be mounted to A.A.R. wheel gauge dimensions and tolerances. The numbering and marking of the axles shall be as per instructions of the Engineer. Wheels on the same axle shall be within 0.005 inch of the same diameter; and the eccentricity of the tread shall not exceed 0.005 inch. Wheels shall be semi-machined as shown on Chicago Transit Authority Drawing RS-5061.

A.A.R. Specifications No. M-107 or A.S.T.M. Specifications No. A-58, of latest issue, shall cover the chemical and physical requirements, heat treatment and temperature regulations for Class "C" rim treated wheels.

A.S.T.M. Specification No. A-25 of latest issue, shall cover the permissible variations in dimensions and all other requirements not covered by preceeding demands.

Finished wheels must be approved by the Engineer before mounting on axle shaft.

Sec. 11 - Trucks (Cont'd.)

11.03 - Design Features (Cont'd.)

(d) Axles: Axles shall have a nominal diameter of 5 inches, be made of S.A.E. No. 4140 steel or equal and shall comply with Transit Research Corporation Specifications. The ends of the axles shall have Presidents' Conference Committee type standard lathe centers, bores and threads which shall be protected by approved hex head cap screws. These lathe centers shall be used for finish machining of the axles. Journal bearings shall be grease lubricated roller type, anti-friction, equal in quality and performance to 5-1/2 by 10 Timken Roller Bearings. Installation and lubrication shall be subject to the approval of the Engineer and a representative of the bearing Manufacturer.

Twelve trucks shall have all axles 6 inches longer than normal on each end to facilitate the test application of an outboard mounted drum brake. These twelve trucks with the long axles shall be placed under six cars having consecutive car numbers.

(e) Transmissions: Gears shall be hypoid type for right angle drive, as approved by the Engineer. The gear ratio shall be specified by the motor Manufacturer to fit the motor being supplied in order to meet the performance called for in this Specification. Gears shall run in an oil bath housing so designed to provide adequate lubrication to both gears and bearings. Drain and filler plugs shall be the magnetic type with hexagon heads unless otherwise approved by the Engineer.

Two inspection openings shall be provided in hypoid gear boxes; one located vertically opposite the pinion for gear inspection and one over the pinion. Cork-neoprene gaskets shall be used at all gear inspection covers. After each hypoid gear unit is completely assembled, it shall be flushed out with clean oil, refilled and run on a test stand in both directions and check made for noise, gear and pinion fit, oil leaks and heating. All exposed shim packs shall be painted with Tousey Sealer compound or approved equal after installation. The axle assembly shall be such that the center line of the pinion shaft of hypoid gear drives shall be in line with the center line of the traction motor armature shaft when the car is complete. Pinion bearing seal must effectively prevent oil leakage at this point. If the speedometer sending unit is attached to the gear drive, the type of sender and mounting shall be approved by the Engineer.

(f) Motor Mount: The motors shall be mounted in the truck in such manner as to provide easy removal. Safety hangers shall be provided to prevent accidental dropping of motors. Motor armature shaft must line up with the pinion shaft of the axle gear unit.

Sec. 11 - Trucks (Cont'd.)

11.03 - Design Features (Cont'd.)

(g) Springs: The springs used in these trucks shall be B-3 combination steel and rubber type, designed to give the smoothest possible ride while meeting the conditions imposed by Chicago Transit Authority's service. All steel springs shall be made of alloy steel, load tested and permanently marked to indicate their height classification. Springs of the same height classification shall be used in a single truck whenever possible; otherwise, spring nests shall be matched and identified using approved shims.

The rubber center springs shall be made of natural rubber having a durometer hardness of 45 ± 3 at a temperature between 70 degrees and 90 degrees F. Dimensions shall be as shown on Transit Research Corporation Drawing C3a-2a1.

The complete spring design shall be approved by the Engineer.

(h) Ground Brush: Each axle shall be fitted with a brush holder and ground brush to by-pass the return current around the roller bearings. Grounding ring shall be S.A.E. No. 62 bronze or equivalent. Ground brush shall contain 75 percent copper or equivalent. Ground brush inspection covers shall be readily accessible.

(i) Shock Absorbers: All shock absorbers needed to insure easy riding shall be provided. Vertical shock absorbers shall be the cylindrical hydraulic type. Shock absorbers for the lateral motion may be either rotary or cylindrical type.

(j) Propeller Shafts: Propeller shafts shall be heavy duty rubber insulated shafts of approved design. Safety hangers shall be provided for the propeller shafts.

(k) Friction Brake: Each motor shall be equipped with a disc friction brake equal in quality and performance to the American Steel Foundries Simplex Rotor Brake with slack adjuster.

(l) Brake Actuator: Each disc brake shall be operated by a spring applied electrically released actuator, equal in quality and performance to Westinghouse Air Brake Company's Model SE-2A actuator with latest improvements. Provision shall be made so the actuator can be manually released from either side of the car.

Sec. 11 - Trucks (Cont'd.)

11.03 - Design Features (Cont'd.)

(m) Track Brake: Each truck shall be equipped with two approved electric track brakes, one mounted over each rail between the wheels. These brakes shall be mounted on an approved cradle fitted with guides or mounted separately with suitable guides to insure the shoes centering over the rails. The track brakes, and cradle if used, shall be supported on four compression type coil springs made of high grade alloy steel. All guides shall be fitted with replaceable wear plates.

(n) Track Trip: Each truck shall be fitted with a bracket for attaching a track trip switch at the left hand front corner. The inside of the trip lever shall be 34-13/16 inches from the center line of the truck and its bottom 2-3/4 inches above the running rail. (Trip switch will be installed only on No. 1 end of car.) A serrated height adjustment shall be provided so that the height of trip switch can be maintained as wheels wear. Trip switch shall be equal in quality and performance to Westinghouse Air Brake Company's A-3A trip switch with contacts relocated per approval of the Engineer but with the operating lever increased 1-1/2 inches in length.

(o) Current Collectors: Each truck shall have brackets on each side for attaching Chicago Transit Authority's standard third rail shoe beam, as detailed in Section 9.05.

(p) Casting Manufacture and Tests

(1) Manufacture and Material

Cast steel components shall be made according to A.S.T.M. A27 or A.S.T.M. A148 Specifications of the latest issue with the exception that carbon content shall be held to a maximum of .25 percent for weldability. The physical and mechanical properties of the cast steel shall be compatible with the design stresses established by the Truck Manufacturer as assuring safe operation.

(2) Sample Castings

The first produced casting from each pattern, or the first produced casting after significant design or pattern changes shall be deemed a sample casting and shall be subject to the following procedure to insure that the casting is satisfactorily sound to meet the Manufacturer's design requirements. If the sample casting doesn't meet the quality standards, the deficient areas shall be subjected to the sample casting procedure until the casting meets all of the quality requirements, or that a given repair can be made to the approval of the Engineer.

Sec. 11 - Trucks (Cont'd.)

11.03 - Design Features (Cont'd.)

(p) Casting Manufacture and Tests (Cont'd.)

(3) Types of Examination

(a) Radiographic to A.S.T.M. E71
(b) Magnetic Particle to A.S.T.M. E109 and E125
(c) Visual to MSS Practice SP-55
(d) Dimensional

(4) Procedure

(a) The first casting from any pattern shall be designated as a sample casting and shall receive 100 percent coverage with the types of examination listed in Section 11.03 (p) (3).

(b) The first casting from a revised pattern due to design changes shall be designated as a sample casting and shall receive the types of examination listed in Section 11.03 (p) (3). If the design change will not affect the casting soundness the Manufacturer may waive the Radiographic and Magnetic Particle examination with approval of the Engineer.

(c) The first casting following a change in foundry practice (such as gating and risering) shall be designated as a sample casting and shall receive the types of examination listed in Section 11.03 (p) (3). If the change in foundry practice will not affect the casting soundness or dimensions the Manufacturer may waive examinations in Section 11.03 (p) (3) with approval of the Engineer.

(d) All production castings shall be given the magnetic particle examination in critical areas shown on sketches to be furnished by the Truck Builder to the Engineer. The examination shall be as called for in Section 11.03 (p) (3) (b) and to be acceptable, shall meet the standards in the following table:

MAGNETIC PARTICLE STANDARDS FOR CRITICAL AREAS

Type of Defect	Reference Photo	Acceptable*
Cracks	Plate 1	I - 1a, 1b, 1c
Shrinkage	Plate 2	II - 1, 2
Inclusions	Plate 2	III - 1, 2
Chills - Chaplets	Plate 3	IV - 1, 2
Porosity	Plate 3	V - 1
Defective Welds	Plate 3	VI - 1

*Refer to Photographs in ASTM E125

Sec. 11 - Trucks (Cont'd.)

11.03 - Design Features (Cont'd.)

(p) Casting Manufacture and Tests (Cont'd.)

(4) Procedure (Cont'd.)

(e) All production castings shall be given a visual inspection as called for in Section 11.03 (p) (3) (c). Acceptability shall be according to the following table:

VISUAL INSPECTION STANDARDS

	Acceptable*	
Type of Defect	Surface To Be Machined	Other Surfaces
Type I Cracks and Hot Tears	a,b,c	a,b
Type II Shrinks	b, d	a,b,c
Type III Sand Inclusions	a,b,c	a,b,c,d
Type IV Gas Porosity	b, d,e	b
Type V Veining	c	a,b,c
Type VI Rat Tails	c	a,b, d
Type VII Wrinkles, Folds	c	a,b,c
Type VIII Cutting Marks	c	a,b, d
Type IX Scabs	a,b,c	a,b,c
Type X Chaplets	b	a,b
Type XI Weld Repair Areas	a,b,c,d,e	a,b, d
Type XII Surface Roughness	b	a,b,c,d

*Refer to photographs in MSS Practice SP-55

(f) Every twenty-fifth set of truck castings shall be checked for wall thickness. Sufficient readings shall be taken to insure that the wall thicknesses are maintained to design values.

(g) One set of films from the radiographic examination in Section 11.03 (p) (3) (a) shall be furnished Chicago Transit Authority. The degree of soundness shall be acceptable to the Engineer.

(h) Each casting shall show the heat number of the steel and the serial and pattern number of the casting. Copies of the physical tests and chemical analysis of each heat of steel shall be given to the Chicago Transit Authority.

(i) Each truck shall carry a metal tag giving the serial number of the assembled truck.

(q) Bolts: All bolts shall be S.A.E. Grade 5 or better.

Sec. 11 - Trucks (Cont'd.)

11.03 - Design Features (Cont'd.)

(r) Nuts: All nuts used on bolts on truck shall be "ESNA" with nylon center or other approved types. Nuts shall be S.A.E. Grade 5 or better. Bolt and nut list with torque specifications shall require approval of the Engineer.

(s) Paint: All truck components shall be given a heavy coat of primer equal in quality and performance to Rust-Oleum X-60 before assembly. After assembly, the truck shall be given two coats of aluminum paint, equal in quality and performance to Rust-Oleum R-470, ready mixed aluminum paint. All grease fittings, linkages, threads which are for adjustment and wearing surfaces, shall be masked before painting.

(t) General: It is the intent of these Specifications that the Car Builder shall furnish trucks that will provide easy riding at speeds up to 65 mph, shall be as light weight as consistent with safety and shall be easy and economical to maintain. Truck frames shall have accurately located tram marks so placed that the finished truck can be easily checked for tram. The truck shall be square, have the axles parallel within plus or minus 1/64 inch and the diagonals tram within 1/16 inch. The design shall be such that this tram shall be maintained under all service conditions of the Chicago Transit Authority.

(u) Major truck components of weldment construction, shall be 100 percent magnafluxed.

(v) All wear plates shall be 11-14 percent rolled manganese steel.

(w) All rubber stops shall be of proper durometer for the use intended.

Sec. 12 - Materials and Workmanship

12.01 - General

(a) All materials entering into the consideration of these cars shall be of first class quality. All workmanship shall be high grade and shall conform to the best manufacturing practices in all respects.

(b) Unless otherwise specified, all materials shall conform to A.S.A. and/or A.S.T.M. specifications.

(c) All materials intended for use in these cars shall be marked or stored so as to be readily identified, and shall be adequately protected during handling and storage.

(d) All interior unpainted metal trim shall be 18-8 stainless steel, satin finish, and all exterior unpainted metal trim shall be 18-8 stainless steel, bright finish, unless otherwise specified.

(e) Lumber shall be thoroughly air seasoned or kiln dried before using and shall be dressed on all surfaces as required.

(f) Plywood shall be exterior grade.

(g) All screws, bolts and nuts shall conform to applicable A.S.A. standards and be cadmium plated. Plating shall be per the latest revision of A.S.T.M. Spec. A-165, Type T.S. Where stainless steel screws are specified, 18-8 material or an approved equal shall be furnished.

(h) All wood and machine screws shall have standard slotted heads.

(i) All bolts, nuts, cap screws and machine screws shall be suitably locked.

(j) Rivet holes and bolt holes shall be accurately located and aligned and, when necessary during assembly, holes shall be reamed round to specified size in position. Hand driven steel rivets shall be driven hot and shall completely fill the holes. Rivets may be cold driven when adequate mechanical equipment is available therefor. All exposed heads of rivets shall be free from rings, fins, pits and burns. If and when aluminum rivets are used, these rivets shall be anodized, in accordance with Alumilite Specification #204.

(k) Huck rivets may be used in locations approved by the Company and Huck representative.

Sec. 12 - Materials and Workmanship (Cont'd.)

12.01 - General (Cont'd.)

(l) Joints shall be properly fitted, whether exposed or concealed, and the surfaces that are to be joined together other than stainless steel shall be given a protective coating to prevent corrosion. All exterior joints shall be weather tight.

(m) All bolts or rods passing through wood shall be coated with an approved paint over those parts imbedded in the wood.

(n) Chrome plating, if used, shall conform to the latest revision of A.S.T.M. Specification A-166-T.

(o) All stainless steel parts shall be attached with stainless steel screws or fasteners.

12.02 - Steel

(a) Structural and Sheet Steel: The underframe, side, roof sheets, carlines, purlines, posts and other main structure parts of an all steel body or the steel parts of a steel and aluminum body shall be made of Cor-Ten steel or approved equal. The grades of material in a stainless steel body shall be designated by the Car Builder, subject to the approval of the Engineer.

(b) Steel Castings

(1) Steel castings shall be commercially sound throughout. The Company reserves the right to cut up one or more of each shape from time to time to determine the character of metal in parts not exposed by the various machine operations. The Company reserves the right to require magnaflux checks in critical areas.

(2) All steel castings used in the truck structure shall be made of steel as detailed in Section 11.03 (p) (1).

(3) The king pin and base thereof which form part of the body shall be made of electric furnace steel that conforms to A.S.T.M. Specification A148, latest revision. The steel shall have the following minimum physical properties:

Tensile Strength	80,000 lb. per sq. in.
Yield Strength	50,000 lb. per sq. in.
Elongation in 2 Inches	22 percent
Reduction in Area	30 percent

Sec. 12 - Materials and Workmanship (Cont'd.)

12.02 - Steel (Cont'd.)

(b) Steel Castings (Cont'd.)

(4) The upper member of the center bearing shall be made of cast steel, heat treated to produce the physical properties in Section 12.02 (b) (3). After heat treatment the bearing surface shall be finish ground.

(5) Steel castings used in locations not referred to herein shall be selected for composition and characteristics best suited to the application, by the Manufacturer or Builder concerned, but shall be subject to approval by the Company.

(c) Stainless Steel

(1) Stainless steel shall conform to the latest revision of A.S.T.M. Specification A-167 Type 302 with approved finish. Where the Manufacturer proposes the use of stainless steel, other than Type 302, this material must have the approval of the Engineer.

(2) Buffing and polishing of stainless steel, where required, shall be done in an approved manner and without the use of any composition containing iron or iron oxide.

(3) If rigidized, pattern and position of pattern shall be approved by the Engineer.

12.03 - Aluminum

(a) Aluminum materials, where used, shall be identified by the designations used either by the Aluminum Company of America or Reynolds Metals Company and shall conform to their Specifications.

(b) The forming of aluminum parts, joining by riveting and welding and the protection of contact surfaces shall follow instructions given by the Aluminum Company of America or Reynolds Metals Company for specified alloys and specific parts.

(c) Buffing and polishing of aluminum, where required, shall be done in an approved manner without use of contaminants.

(d) If embossed, pattern and its position shall be approved by the Engineer.

(e) Anodizing, where furnished, shall have the approval of the Engineer.

Sec. 12 - Materials and Workmanship (Cont'd.)

12.04 - Rubber

(a) General

(1) All rubber specified herein shall be so compounded and cured that it will perform satisfactory in car operation at any temperature between -40 degrees F. and 120 degrees F., and shall have the longest possible commercial life consistent with obtaining the other characteristics specified.

(2) Unless otherwise specifically stated herein, all tests shall be conducted according to the latest revisions of A.S.T.M. test procedures for rubber goods. Certified copies of results of all tests shall be furnished to the Company, as required by the Engineer.

(3) Specimens shall be tested two to ten days after manufacture.

(4) When tests are specified to be made at any particular temperature, the Company and Manufacturer shall agree in advance on the factor to be applied to readings obtained at any other temperature.

(5) When tests for drift under load are specified, they may be made at any convenient temperature between 50 degrees F. and 80 degrees F. providing that the temperature at the beginning and end of the test is the same. The test shall be made under conditions subjecting the rubber specimen to continuous vibration. This may be obtained from vibration of the building caused by operating machinery, it may be produced artificially by a small motor carrying an off-center weight or by equivalent means. If produced artificially, the frequency of vibration shall be between 1000 and 2000 cycles per minute.

(6) The Manufacturer shall guarantee all rubber parts to be free from defects of material and workmanship. For all parts made by curing rubber to metal, any premature failure between metal and cement or cement and rubber occurring when the part is used in normal service and according to the provision of the Specification, shall be considered as caused by a defect of material and/or workmanship.

(7) Synthetic rubber may not be substituted for natural rubber unless so specified hereinafter.

(b) Rubber Truck Springs

(1) Rubber truck springs shall be so designed, compounded and cured as to meet the load and other requirements of these Specifications.

Sec. 12 - Materials and Workmanship (Cont'd.)

12.04 - Rubber (Cont'd.)

(c) Rubber Stops for Track Brake Cradle, for Bolster Bumpers and for Rubber Snubbers

(1) These stops may be made of natural or synthetic (GRS) rubber. Bolster snubbers, if used, shall be faced with 11-14 percent rolled manganese steel.

(2) The rubber parts shall be so compounded, fabricated and cured that the durometer hardness, measured with a Shore Type A durometer on the end of stop in the free condition, shall be 60+5 at a temperature between 70 degrees F. and 90 degrees F.

(3) The rubber shall have the highest resistance to abrasion which is compatible with the other characteristics herein specified.

(d) Rubber Axle Housing Sleeves and Journal Box Sleeves

Axle or journal box sleeves, if used, shall be made of natural rubber, 60+5 durometer, subject to the permanent set test as required under A.S.T.M. Specification, D395-49T, Method B. Any deviation shall require the approval of the Engineer.

(e) Rubber Door Edges

(1) All U-shaped door edges shall be made of non-oxidizing new natural rubber, over 1 ply 12 ounce duck 1/32 inch in thickness.

(2) They shall be free of major defects in material and workmanship.

(3) The tensile strength shall not be less than 3500 lb. per sq. in. nor the elongation less than 550 percent when tested by A.S.T.M. methods.

(4) The tensile strength of the rubber shall not be reduced more than 25 percent when subjected to 96 hours of accelerated aging in an air oven at 70 degrees C. as determined by A.S.T.M. tests.

(f) Rubber For Door and Window Seals and Glazing Strips

(1) All rubber for door and window seals and glazing strips shall be extruded from an approved rubber and be free from major defects in material and workmanship.

(2) The physical properties shall be suitable for the installation design.

Sec. 12 - Materials and Workmanship (Cont'd.)

12.05 - Safety Glass

(a) All safety sheet glass shall be of the laminated type, consisting of two pieces of glass bonded with "Flexigum" or a plasticized polyvinyl butyral resin membrane approximately 0.015 inch thick and resistant to ultra-violet and visible light and heat. Glass used in front cab windows shall be free of optical strains.

(b) When an individual light is laid on a truly flat surface, the glass shall not indicate a bow of more than 0.030 inch per lineal foot.

(c) The overlap of one sheet of glass with respect to the other at the edge shall not exceed 1/32 inch. Corners and burrs shall be ground smooth and all edges shall be seamed, or swiped.

(d) The over-all dimensions of individual lights as supplied shall be held within 1/16 inch of the dimensions ordered.

(e) The bond between the two sheets of glass and the membrane shall be of such quality that when the glass is broken by shock, by twisting or direct impact there shall be no material separation of the laminations.

(f) There shall be no appreciable variation in color in the individual lights of laminated plate or sheet glass when examined over a white background.

(g) All lights of laminated plateglass shall be so nearly free from haze that the laminated glass shall have approximately the same clarity as a light of the same normal thickness of plate glass when viewed against a north light.

(h) Occasional specks of foreign material are permissible provided such specks do not exceed 0.020 inch in greatest dimension.

(i) No lights containing unbonded areas (let-goes) shall be accepted.

(j) Safety sheet glass shall produce no apparent distortion on a line at right angles to the plane of the glass.

(k) All questions regarding the quality of safety glass shall be settled by the test methods prescribed in the A.S.A.'s latest revision of American Standard Z-26.1, "Safety Code for Safety Glass for Glazing Motor Vehicles Operating on Land Highways."

(l) Each light of safety glass shall have Manufacturer's etched trade mark.

Sec. 12 - Materials and Workmanship (Cont'd.)

12.06 - Wire and Cable

(a) Conductor Material

(1) All conductors shall be of soft annealed copper, properly tinned, and shall have the properties and characteristics specified in the latest revision of A.S.T.M. Specification B-33.

(2) Wires for control and auxiliary circuits shall not be smaller than No. 12, AWG, except for special apparatus such as public address system, heat or ventilation control equipment, where special types of wires are recommended for use by the Manufacturers for interconnection of their various pieces of equipment.

(b) Separator

A paper separator shall be used between copper and rubber insulation, except that the separator may be omitted if a free stripping type of insulation is used. The paper separator is not required on asbestos insulated wire and cable.

(c) Rubber Insulation

(1) Rubber insulation shall conform to the latest revision of A.S.T.M. Specification D-1679, "Insulated Wire and Cable: Performance Synthetic Rubber Compound."

(2) The thickness of rubber insulation and the number and type of coverings over the insulation shall be as given or recommended by the electrical Manufacturers approved by the Company, but shall not be less than the dimensions indicated by the A.S.T.M. specifications referred to herein.

(3) Braids and sheaths used with rubber insulation shall be at least equal to A.S.T.M. standard braid or sheath compound as covered in the latest revision of A.S.T.M. Specification D-1350 or D-752. Braids shall be thoroughly saturated with black flame retarding moisture resisting compound. At least two cotton braids shall be used.

(4) An oil resistant synthetic jacket complying with A.S.T.M. Specification D-752, which has been approved for car and trolley bus wiring shall be used for the outer jacket of track brake, motor and trolley leads.

(d) Asbestos Insulation

(1) The thickness of the component parts of asbestos insulation shall be as given by the electrical Manufacturers approved by the Company. The minimum thickness shall not be less than 90 percent of the average thickness.

Sec. 12 - Materials and Workmanship (Cont'd.)

12.06 - Wire and Cable (Cont'd.)

(d) Asbestos Insulation (Cont'd.)

(2) Felted asbestos or braid shall consist of best quality, long-fibre, chrysotile asbestos commercially free from foreign particles of dirt, cotton seed and metallic oxides. It shall be well carded to prevent lumps and irregularities in the finished cable. After extraction of impregnating compound, it shall contain not less than 80 percent of asbestos by weight. The total iron content shall not exceed 4 percent of asbestos by weight and the magnetic iron content shall not exceed 2 percent of asbestos by weight.

(3) The felted asbestos shall be applied to form a smooth wall of uniform thickness with the conductor well centered. It shall be thoroughly dried and completely saturated with a flame, heat and moisture resisting compound. This compound shall retain its initial qualities during the normal life of the cable. The compound shall develop no injurious chemical action within itself or with any component parts of the complete cable.

(4) Varnished cambric insulation in asbestos insulated wires and cables shall consist of a high-grade varnished cloth, substantially free from blisters or other imperfections applied with a lubricating compound between layers. It shall comply in all respects with the requirements for varnished cloth outlined in the latest revision of the "Standard for Varnished Cambric Insulated Cable" of Insulated Power Cable Engineers Association.

(e) Varnished Cambric Insulation

Varnished cambric insulated cables shall conform to the latest revision of the "Standard For Varnished Cambric Insulated Cables" of the Insulated Power Cable Engineers Association.

(f) Silicone Rubber Insulation

(1) Silicone rubber insulation shall be rated 200 degrees C., Class H.

(2) The silicone rubber thickness shall be at least 2/64 inch for wires #20 through #12, 3/64 inch for #10 wire and 4/64 inch for wires #8 through #2.

(3) Braid shall be glass yarn, at least 0.009 inch thick.

Sec. 12 - Materials and Workmanship (Cont'd.)

12.06 - Wire and Cable (Cont'd.)

(f) Silicone Rubber Insulation (Cont'd.)

(4) Silicone rubber insulated wire shall be equal in quality and performance to Rockbestos Table SR-ML.

(g) The sizes, stranding, and types of insulation shall be suitable for the uses and types of service described in these Specifications.

(h) No thermoplastic insulated wire shall be used.

12.07 - Wiring

(a) General

(1) The work shall be performed by or under the direction of an experienced wireman. The wireman shall be provided with appropriate tools for skinning insulation, cutting, tinning, soldering and attaching mechanical or compression type terminals to conductors.

(2) Care must be taken in removing insulation from the conductor to avoid nicking of the wire or strands of the conductor cable.

(3) Wire in ducts shall be free of kinks. Wire in conduit shall be in one piece between boxes.

(b) Solder shall be at least equal to that designated as S.A.E. No. 1, Class B. A flux of non-corrosive type shall be applied immediately before soldering.

(c) Insulating tape shall be a polyvinyl chloride electrical tape having unrestricted qualification under Specification MIL.-I-7798A, 0.007 inch overall thickness. The friction tape used over this polyvinyl tape shall be of a good quality cotton tape filled with a heavy rubber compound that will resist aging and shall comply with A.S.T.M. Specification D69, latest revision.

Sec. 12 - Materials and Workmanship (Cont'd.)

12.07 - Wiring (Cont'd.)

(d) Ends of conductors to be soldered shall be thoroughly cleaned and tinned by immersion in molten solder. Care must be exercised to prevent burning the insulation and excessive flowing of the solder along the conductor. Terminals which are attached by soldering shall be thoroughly cleaned and recently tinned before attachment to the conductor.

(e) Conductors may be soldered to terminals or they may be attached by mechanical means where the use of an approved type of solderless terminals has been authorized. Where possible the terminal used shall be of the type which will securely grip and hold the insulation of the conductor on wires of No. 10, AWG, size or smaller. Conductors which will be subjected to motion relative to the terminal shall be supported by suitable means to minimize breakage of the conductor at or near the terminal. Solder or mechanical terminals shall be attached without exposing conductors between insulation and terminals.

(f) Jack knife connectors shall be attached to the motor leads with solder. The connector cups shall contain only sufficient molten solder to fill the cup after the conductor has been inserted. Exposed conductors will not be acceptable.

(g) Splicing and Taping

(1) Splicing of conductors is not recommended. Where it is approved the spliced joint shall be mechanically as strong as any other part of the conductor, without the use of solder. However, the joint shall be soldered to insure electrical continuity and wiped or filed to remove fins and burrs of hard solder. Approved solderless connectors may be used for splicing. The joint shall be insulated with tape so as to be at least equivalent to the insulation of the conductor. The outside diameter of the spliced portion of the cable after the tape insulation is applied shall not exceed the outside diameter of the unspliced portion by more than 40 percent. The finished splice shall be painted with one coat of approved insulating compound.

(2) A conductor shall be taped on to another conductor only when approved by the Company and then the method of attachment and insulation described in (1) above shall apply. Tee splicing is prohibited.

Sec. 12 - Materials and Workmanship (Cont'd.)

12.08 - Welding

(a) The Car Builder, shall be responsible for the quality of all welding, and all welders employed in the making of welds on structures or products built under these Specifications shall have been tested to determine their ability to operate the welding equipment to be used in making the types of welds required hereunder.

(b) The Company shall have the right to require the making of test welds by any operator to determine his ability to produce satisfactory welds of any given type. The Company shall also have the right to require the making of test welds to settle any question which may arise as to the suitability of any welding method or procedure used during production. The recommendations of the American Welding Society as contained in the latest revision of their "Standard Qualification Procedure" shall be followed in the making of tests and the settlement of other questions which may arise hereunder regarding the welding practices.

(c) Before welding of any sort is started, parts to be joined shall be properly cleaned. All corrosion or rust, oil, water and other foreign matter shall be removed by an approved process or method.

(d) All parts which are to be joined by welding shall be adequately supported in proper interrelation by tables, jigs or fixtures.

(e) Welding rod or wire or filler metal shall be chosen with respect to make, type and size by Car Builder, Truck Builder or Manufacturer.

(f) Filler metal shall be purchased in packages of convenient sizes and shall be marked with the following information:

Make
Specification Number
Diameter
Net Weight

This material shall be stored and handled as to protect it from damage and so that it can be easily identified. Filler metal shall be issued and handled in such a way as to prevent materials of a given specification being mixed with those of another specification.

(g) In case a question shall arise regarding the suitability of given electrodes, shielding material or filler metal for the work covered by these Specifications, the latest revision of the joint American Welding Society and A.S.T.M. tentative specifications for Welding Electrodes and Rods, shall govern.

Sec. 12 - Materials and Workmanship (Cont'd.)

12.08 - Welding (Cont'd.)

(h) Current, voltage, distance, flame and other variables shall be so controlled as to give a reasonably smooth weld free of gas pockets, oxide inclusions, excessive variations in width and thickness, excessive wandering, spattering and undercutting.

(i) Penetration of weld metal into the bottoms of angles and vees, and fusion at these points shall be complete. Weld metal shall run into the base metal at the finished surface of the weld in a smooth curve approximating tangency to the surface of the base metal so as to avoid sudden change of section and resultant concentration of stress.

(j) The method used in depositing the weld metal shall be chosen so as to minimize warpage and locked-up stresses. To this end, tack welding, skip welding, offset welding and other devices and sequences well known in the art shall be used where necessary.

(k) Steel parts rotating at high speed and other parts in which locked up stresses serve as a source of danger shall be heat treated after welding for stress relief. When the base metal contains 0.3 percent carbon or less, this shall be done by heating the structure slowly in a furnace to a temperature of 1100 degrees F. to 1200 degrees F., holding for one hour per inch of thickness at that temperature, then cooling slowly to at least 250 degrees F. before removal from the furnace. When the carbon content of the base metal is above 0.3 percent the annealing temperature shall be 1425 degrees F. to 1475 degrees F.

(l) Finished welds which have a thickness greater than 1/4 inch shall be made with at least two beads, unless otherwise approved by the Engineer. The scale shall be completely cleaned off the underlying bead and surrounding metal after cooling and before the next bead is deposited.

(m) The following requirements shall be met by welding rod or wire used for the various types of welding indicated:

(1) For manual electric fusion welding, electrodes shall be of the heavily coated, shielded arc type, unless otherwise specifically approved by the Company.

(2) For automatic electric fusion welding, uncoated electrode wire may be used when necessary.

Sec. 12 - Materials and Workmanship (Cont'd.)

12.08 - Welding (Cont'd.)

(n) For carbon arc welding, a shielded carbon arc shall be used. The method and material for shielding and the filler metal, if used, shall be best suited to provide welds of good quality.

(o) Manual fusion welding by the gas process may be used in butt welding of sheets 3/32 inch and less in thickness and, at the option of the Company in other work.

(p) Spot or Plug Welding

(1) Spot or plug welding to produce welds which carry structural stresses, as for example those fastening side sheets to structural members, shall be done only with equipment fitted with time, current and pressure control.

(2) The Builder or Manufacturer shall determine experimentally, or in other acceptable fashion, the proper setting of the controls and shall then provide against unauthorized changes.

(3) The size, shape and surface conditions of the electrodes required to give satisfactory welding and acceptable finish shall be determined similarly and a complete record made thereof. Thereafter the electrodes shall be dressed to these conditions as frequently as the character of the work requires.

(4) The Builder or Manufacturer shall so treat surface marks resulting from welding as to minimize all visible defects in the finished surface.

(q) The welding of stainless steel, or aluminum, shall be done in accordance with recommendations of the manufacturers of the materials being welded.

12.09 - Paint and Painting

(a) General: The car shall be painted both inside and outside in conformity with the decorative scheme decided upon by the Authority after submission of decorative schemes by the Car Builder. All finishes used in both the interior and exterior of the car shall be the best quality prevailing in railway finishes and materials used shall comply with Chicago Transit Authority's Specifications. All painting shall comply with the paint Manufacturer's recommendations. Stainless steel or anodized aluminum used on the exterior or interior of the car need not be painted except where it is required by the decorative scheme decided upon by the Authority.

Chicago Transit Authority shall furnish, but the Car Builder shall apply all decalcomania transfers of insignia, lettering and car numbers. Samples of these decals will be furnished at pre-bid meetings. The exterior car numbers shown on Chicago Transit Authority Drawing RS-5119 shall be applied to special number windows. The

Sec. 12 - Materials and Workmanship (Cont'd.)

12.09 - Paint and Painting (Cont'd.)

(a) (Cont'd.)

numbers shall be applied to the sand blasted side of the window glass (4 per car) by means of pressure sensitive numeral stencils per Chicago Transit Authority Drawing RS-5095. A baked black enamel background shall be applied to the glass subject to the approval of the Engineer. Removing the stencils, leaves white numerals on a black background. The installation of Chicago Transit Authority standard numerals between laminated sheets of glass, or other approved material, will be acceptable subject to the approval of the Engineer.

All painting shall be done in an area free from dust and dirt and any painted surface which shows the presence of dust or dirt shall not be acceptable.

All grease fittings, threads which are for adjustments, and wearing surfaces, shall be masked before painting.

(b) Priming: All metal parts of the car other than stainless steel or anodized aluminum, after all forming, drilling and machining has been completed and prior to assembly, shall be thoroughly cleaned of all grease, oil, oxide film, paint, welding flux or other injurious foreign matter and immediately given a coat of zinc chromate primer. All weldments shall have slag removed, be primed and painted. All metal parts used in the construction of the cars which are made of aluminum to be finish painted, either plate, strip, sheet, extrusion or castings, shall have their surfaces thoroughly cleaned of grease and oil as noted above and then shall have their surfaces properly prepared by an approved chemical deoxidizer prior to the application of the zinc chromate primer.

After the metal shell is completely assembled, it shall be properly cleaned and immediately given a heavy coat of zinc chromate primer, except where stainless steel or anodized aluminum is used. After drying time prescribed by the primer Manufacturer, the following coats shall be applied to the interior and exterior.

(c) Exterior Painting: If other than stainless steel, or anodized aluminum, apply two (2) coats of Pratt & Lambert, Inc. Transportation Primer Surfacer gray, or equal, allowing to dry over night.

Glaze with glazing putty where necessary and allow to dry over night.

Sand surfaces smooth.

Sec. 12 - Materials and Workmanship (Cont'd.)

12.09 - Paint and Painting (Cont'd.)

(c) (Cont'd.)

Apply two (2) coats of Synthetic Alkyd Resin Type Enamel, allowing sufficient drying time between coats.

Chicago Transit Authority shall specify painting scheme, and color by Container Corporation of America Color Harmony Manual, hue and number.

(d) Interior Painting: The interior where painted shall follow in a general way the method specified for the exterior using a synthetic full gloss enamel. Chicago Transit Authority shall specify painting scheme, and colors by Container Corporation of America Color Harmony Manual, hue and number.

(e) Rust Proofing: The insides of the posts and side sills shall be given a coat of rust preventive, equal in quality and performance to Pratt & Lambert, No. 1, asphaltum varnish, after assembly. The underside of the roof sheets, where they are concealed by the interior finish, and the entire interior surface of the side sheets and posts shall be sprayed with at least a 1/8 inch thick, when dry, coat of asphalt base preparation. This material shall be Mortex No. 4 or equal. A similar approved material shall be applied to stainless steel bodies as a sound deadener.

(f) Underframe Painting: Each member of the car underframe shall be given a coat of approved primer at the joints before assembly. After assembly, the entire underframe shall be cleaned in an approved manner so that rivets and welds may be inspected before applying a heavy coat of primer. If the underframe members are constructed of stainless steel, they may be left unpainted.

(g) Wherever dissimilar metals are joined, both members shall be coated with an approved material to prevent electrolysis.

(h) Undercar Painting: The entire underside of the car, including the equipment boxes, if unpainted, shall be painted with two (2) coats of approved black paint. If the car or any enclosure on the underside of the car is constructed of stainless steel, it may be left unpainted. Any exposed equipment as directed by the Engineer shall be masked before painting. Car number shall be stenciled on the underside of the floor, location to be as directed.

Sec. 13 - Bids and Options

13.01 - Drawings

The Car Builder shall submit with his bids, an artist's sketch, in colors and in perspective, showing the exterior of the car as it is proposed to be built. Prints of the following details of the car shall also be submitted.

Plan and Elevation
Cross Sections
Cab Layout
Ventilating and Heating System
Framing (both designs)

The successful bidder, after receipt of the order, shall prepare both interior and exterior color schemes of the car for approval of the Engineer.

13.02 - Options

The Car Builder shall submit bids and estimated weights on the following:

(1) The price and weight, without air conditioning, of a complete two-car unit with frames designed and to be static tested to 200,000 pounds as described in Section 3.03 (d).

(2) The price and weight, without air conditioning, of a complete two-car unit with frames having an initial strength of 100,000 pounds but increasing to 200,000 pounds at a deformation of 2 feet as described in Section 3.03 (e). The cost of this option shall be priced on a two-car, semi-permanently coupled unit, prorated on the number of such connected two-car units in this order.

(3) Air Conditioning

(a) General: The Car Builder shall furnish, as an option, a bid covering the cost of a two-car unit having air conditioning system as generally referred to herein. The cost of this system shall cover cars having fixed windows of approved tinted laminated safety sheet glass set in glazing rubber, a ventilating system compatible with air conditioning, but with a heating system similar to that described in Section 7.02. All equipment requiring periodic maintenance shall be mounted so as to be readily accessible. The air conditioning equipment and installation, as well as any changes from the car as previously described, shall be approved by the Engineer.

The Car Builder shall furnish with his bid the estimated weight of cars under Section 13.02, Options 1 and 2, with air conditioning equipment installed complete with controls.

Sec. 13 - Bids and Options (Cont'd.)

13.02 - Options (Cont'd.)

(3) Air Conditioning (Cont'd.)

(b) Equipment

(1) The Car Builder shall furnish and install a 9 to 10 ton air conditioning system in each car, equal in quality and performance to Safety Electrical Equipment Corporation's equipment, and shall require approval of the Engineer.

Design Conditions:

Number of Passengers		125
Temperatures:		
Outside	95 deg. D.B.	75 deg. W.B.
Inside	75 deg. D.B.	50-55 percent R.H.
Total Air		2700 CFM
Fresh Air		800 CFM
Each Minute		20 second stop
Doors Open		15 seconds each 80 seconds

The system shall continue to operate at 10 deg. F. above design conditions at reduced capacity.

(2) A compressor and condenser shall be mounted on each car on a steel frame and located under the floor on vibration absorbing mounts. A single 600 volt dc motor shall drive both the compressor and the condenser fan. Compressor shall be of rugged design suitable for transportation service, arranged to start with cylinders unloaded. The condenser shall be the "pull-through" type and shall have copper tubes and copper fins of suitable thickness and spacing as well as a steel coil casing. The motor shall be capable of operating on all voltages from 450 to 650 volts dc with occasional swings from 400 to 750 volts. Insulation shall be at least Class B, varnished and baked to be impervious to moisture. The compressor shall supply the required refrigeration when motor isoperating at 450 volts dc.

(3) A control box shall be mounted close to the compressor motor with a switch to start and stop the compressor motor. The switch shall provide a position to by-pass the thermostats as well as an "Auto" position for normal use. The box shall also contain a high and low pressure switch to protect the compressor, suitable gauges, with shut-off valves, recalibration and restriction devices, for reading the compressor suction and discharge pressures, and connections for charging and purging the system.

Sec. 13 - Bids and Options (Cont'd.)

13.02 - Options (Cont'd.)

(3) Air Conditioning (Cont'd.)

(b) Equipment (Cont'd.)

(4) A receiver shall be mounted close to the condenser sized to hold 100 percent of the system refrigerant charge. The receiver shall have inlet and outlet valves, and a 1/4 inch purge valve. There shall be two bulls-eyes for determining the liquid level in the receiver.

(5) The evaporator sections shall be mounted in the ceiling. The air from the plenum chamber shall, after passing through the evaporator coil and heater coil, be discharged through a set of adjustable louvers supplied by the Car Builder. The evaporator unit shall be divided into two 4.5 to 5 ton units, each discharging air in opposite directions.

(6) Air distribution in the car shall be accomplished by the adjustable louvers set into each end of the overhead evaporator section or other approved means. Return air shall be drawn from the car body through a grille set in the middle of the bottom panel of the overhead sections.

(7) The evaporator coil shall have copper tubes, size to be approved by the Engineer, with aluminum fins. Its circuiting shall be divided horizontally for modulation, one-half being controlled by a solenoid valve. The drip pan, fastened beneath the evaporator coil, shall be of non-corrosive material with splash angles and sufficient insulation to prevent condensation. Two 1 inch drain connections shall be located one on each side of the drain pan. These shall be connected by means of a Neoprene or plastic connector to the drain lines, one on each side of the car, furnished by the Car Builder. Each drain line shall be equipped with a trap supplied by the Car Builder which shall be removable for cleaning and filling.

(8) The type and size of the evaporator blower motors shall require the approval of the Engineer. These motors shall be operated on the 600 volt dc (nominal) line and must meet the insulation and operating requirement of paragraph 2. The blower fans shall be capable of delivering a minimum of 1350 cfm of air, during train operation, against an external static pressure which shall not exceed 0.3 inches of water. Blower motor controls shall provide operation for heating in winter as well as for air conditioning.

Sec. 13 - Bids and Options (Cont'd.)

13.02 - Options (Cont'd.)

(3) Air Conditioning (Cont'd.)

(b) Equipment (Cont'd.)

(9) The heater section shall be provided as part of the overhead evaporator unit. It shall operate on the 600 volt line with a rating sufficient to reheat the air and control the humidity in the air to a degree as specified during cooling cycles, and provide overhead heat during the winter season. Control shall be provided for a single step of heating. The heaterrods shall be of an approved manufacture and shall be supplied with secondary insulation. An overheat protection device shall be supplied to shut off the heaters in event of a blower fan failure. Interlocking shall be provided to prevent the air conditioning system from operating during winter heating period.

(10) Air filters shall be provided by the Car Builder and installed in the plenum chamber. These shall be a heavy duty railroad type with oiled wire mesh which can be cleaned and reused, nominal thickness of 2 inches. Filters shall be easily removable for cleaning.

(11) Proper operation of the refrigeration equipment shall be insured by the use of two thermal expansion valves with thermal ballasted power elements, liquid line sight glass and moisture indicator, proper size filter drier with replaceable cores, vibration isolators in all refrigerant lines going to resilient mounted components, a heat exchanger in the liquid and suction lines as close to the evaporator as possible and all necessary valves and fittings.

(12) A control panel shall be provided for the system. Contactor coils shall operate between 22 volts and 41 volts. The panel shall provide across-the-line starting for the blower motors with the switch in the cab, and step starting for the compressor motor. Control circuits shall provide a high-low pressure switch to protect the compressor, a thermostat set for 77 deg. F. to operate a solenoid valve for modulating the evaporator coil, a thermostat set for 75 deg. F. to stop the equipment, a series coil in the 600 volt line to break the low voltage control circuits when the 600 volt power is broken and the necessary circuit interrupting devices in both the control and power circuits. The above listing of controls does not preclude any other circuits specified in other paragraphs of the general car specifications.

Sec. 13 - Bids and Options (Cont'd.)

13.02 - Options (Cont'd.)

(3) Air Conditioning (Cont'd.)

(b) Equipment (Cont'd.)

(13) Testing: The air conditioning equipment shall be tested by the Manufacturer, at his plant, using a test setup which shall demonstrate the suitability of the components. The equipment shall demonstrate its ability to operate normally and at full capacity at design conditions and to continue to operate at 10 deg. above these conditions. The equipment shall be designed to fulfill these conditions without shortening normal life or damaging the motor insulation. The equipment shall be tested by the Car Builder only to check all control and power circuits for proper functioning.

(14) The condenser shall have mounted on it a pressure operated switch to reduce the load on the refrigeration system and to keep it operating when it otherwise might cut out completely on high head pressure. The switch shall be set to modulate the evaporator coil at a head pressure 15 psi under the high pressure setting.

(15) The air conditioning system Manufacturer shall furnish competent instructors to conduct classes on Chicago Transit Authority property, teaching the functions and trouble-shooting procedures to maintain the system efficiently. Approximately 50 instruction manuals, and parts lists as requested, shall be furnished for the Maintenance and Stores Departments. The instruction and furnishing of manuals and parts list shall be furnished at no cost to Chicago Transit Authority.

13.03 - Weights and Evaluation of Bids

(a) The Car Builder shall furnish an estimated weight for the complete two-car unit under each of the options on which he submits a bid. The Car Builder's bid will be adjusted upward or downward, for bid evaluation purposes only, at the rate of two dollars ($2.00) a pound that his estimated weight is under or over the Specification light weight of 45,000 pounds per car. This adjustment will in no way affect the purchase price.

(b) (1) A penalty will be imposed on the Car Builder when the light weight of the car as constructed and fully equipped is in excess of the estimated weight of the car as submitted in the bid.

Sec. 13 - Bids and Options (Cont'd.)

13.03 - Weights and Evaluation of Bids (Cont'd.)

(b) (Cont'd.)

(2) Should changes in the car be authorized after the Contract is let, the estimated weight of the complete car shall be adjusted upward or downward at the same time that the charge or credit for the change is authorized.

(3) The Car Builder shall pay to Chicago Transit Authority a penalty for any excess weight of each completed car at the rate of two dollars ($2.00) a pound for the excess above the estimated weight submitted in his bid, adjusted as detailed in Section 13.03 (b) (2).

APPROVED.....Clark..... DATE.March 4, 1963.
ENGINEER OF EQUIPMENT
CHICAGO TRANSIT AUTHORITY

APPROVED.................. DATE.March 4, 1963.
GENERAL SUPERINTENDENT OF ENGINEERING
CHICAGO TRANSIT AUTHORITY